THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LIX. No. 1496.] LONDON, JANUARY 12, 1892. [44TH YEAR. PRICE 6d.

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1879-1890.

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This Work (which is a continuation of that published in 1879 by the late Mr. G. W. Stevenson) contains information as to the practice of Parliament during the past twelve years, in regard to most of the points on which differences arise in Opposed Bills for Gas and Water Undertakings. The greatest care has been taken in its compilation; and it is arranged in a very handy form.

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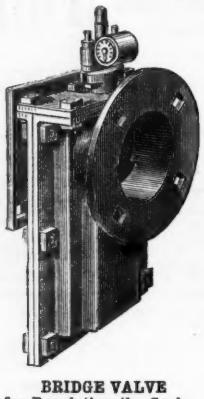

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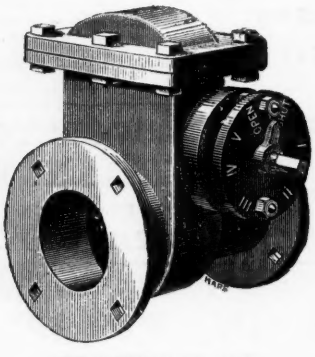

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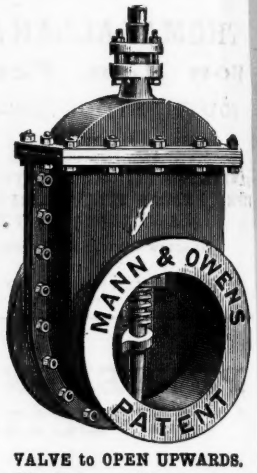

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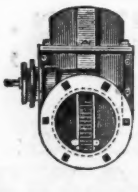

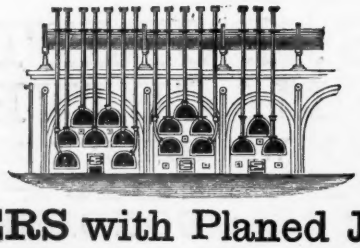

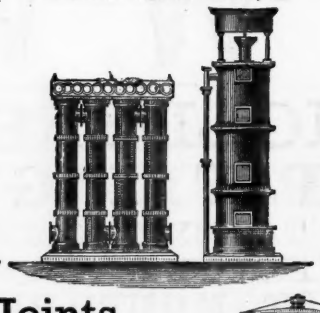

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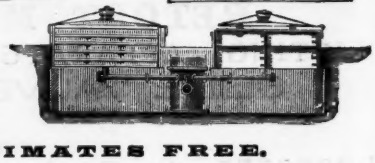

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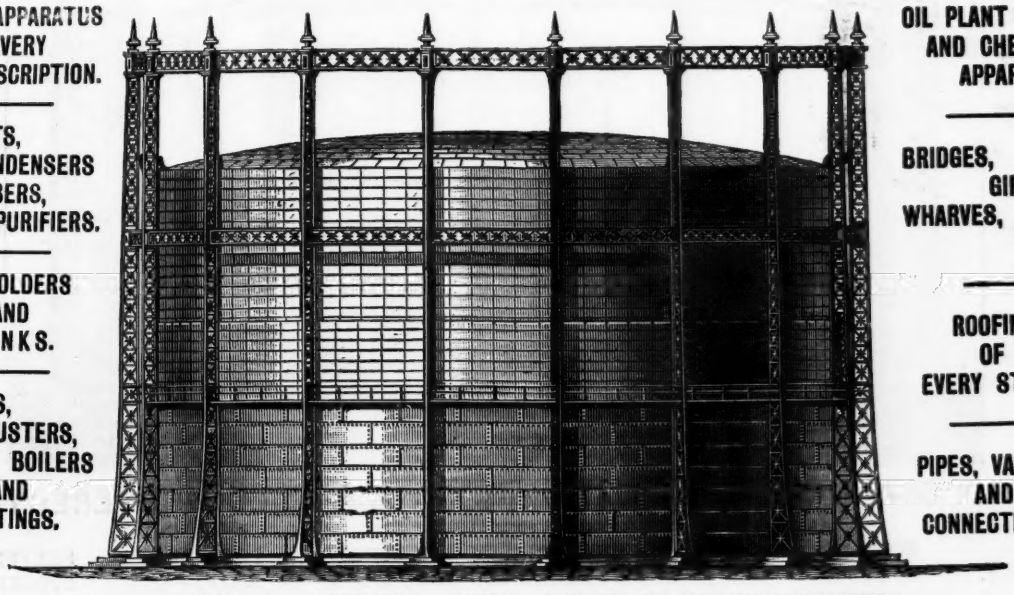

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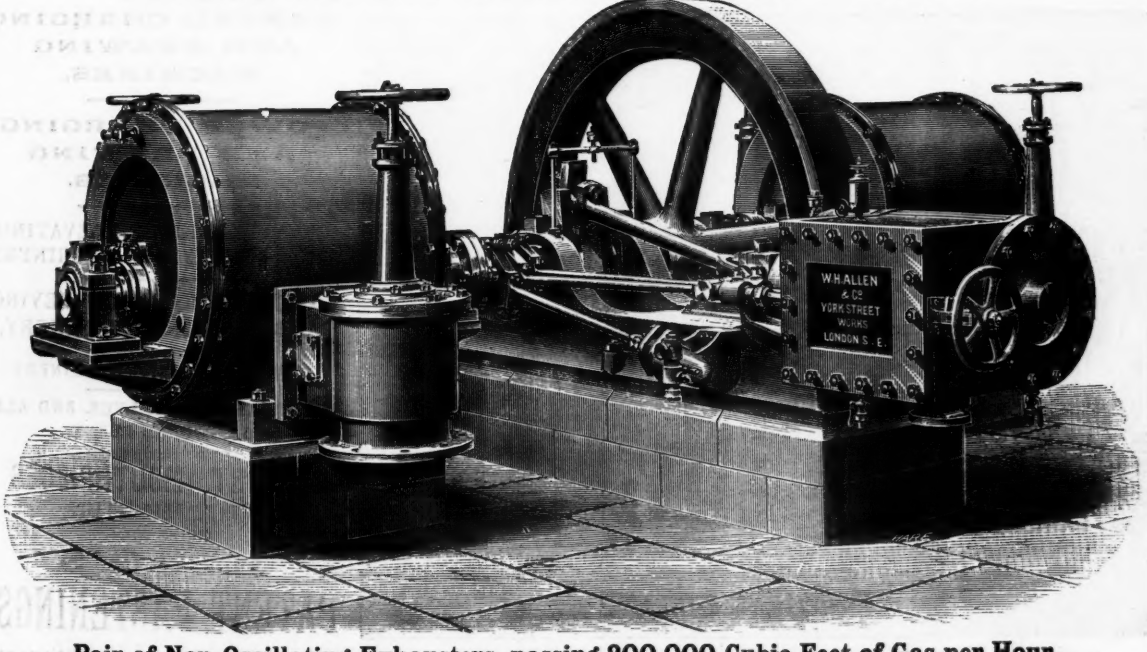

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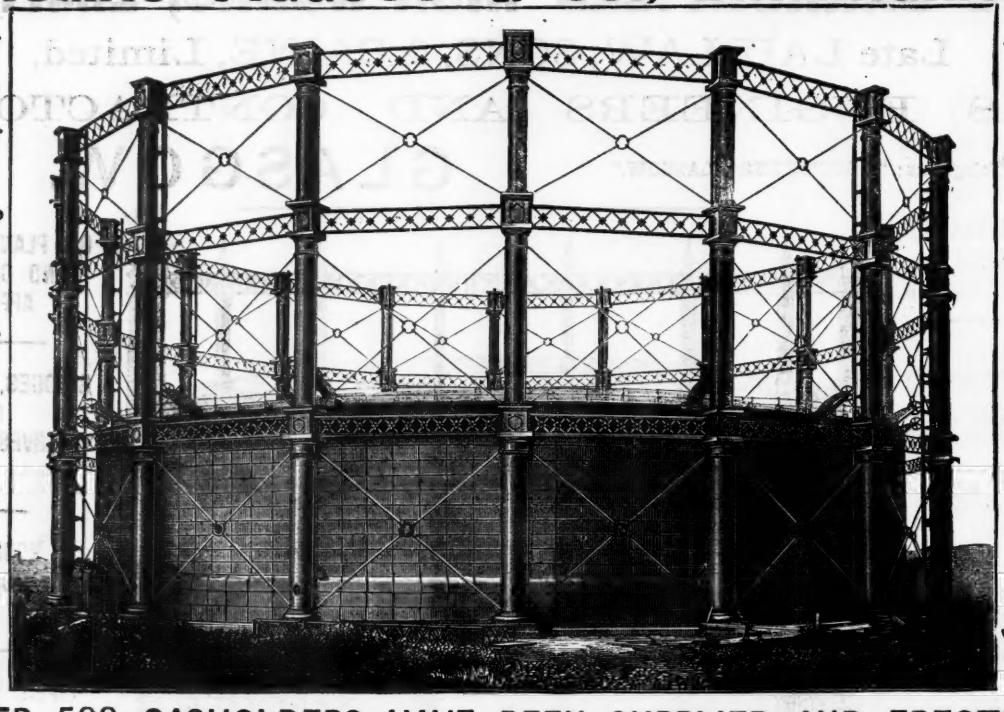

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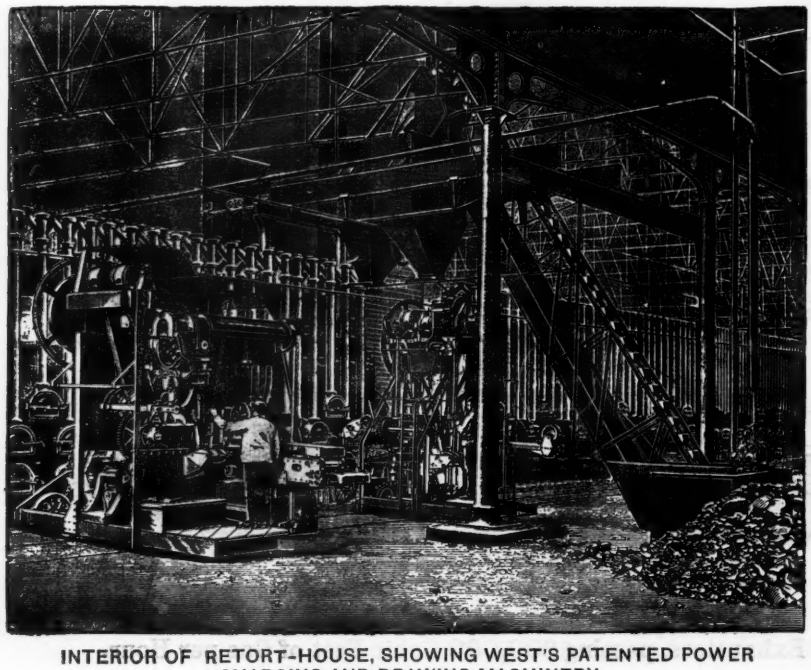

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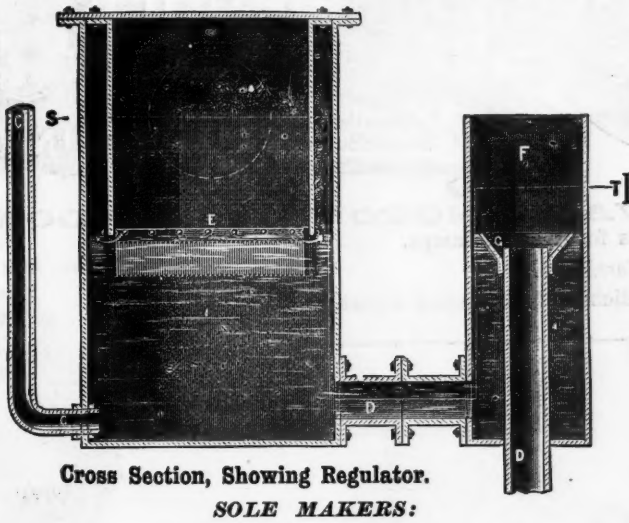

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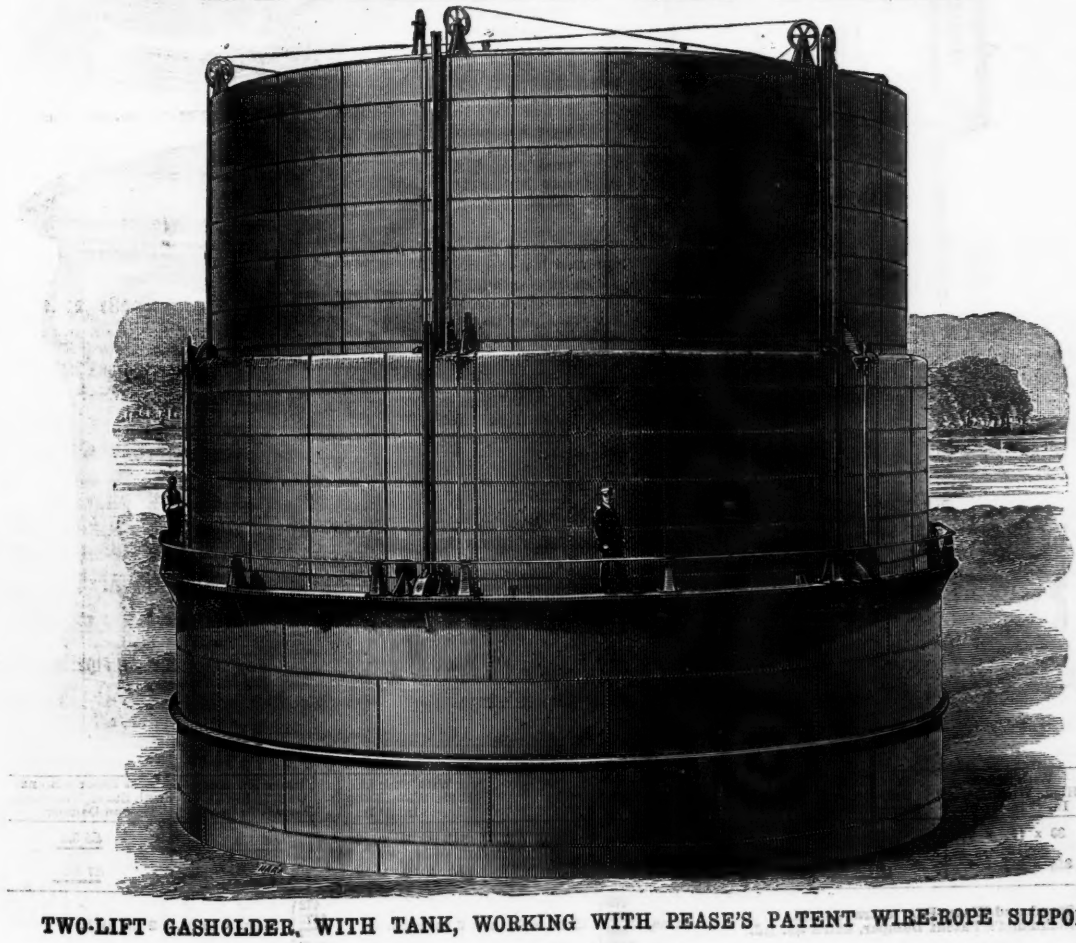
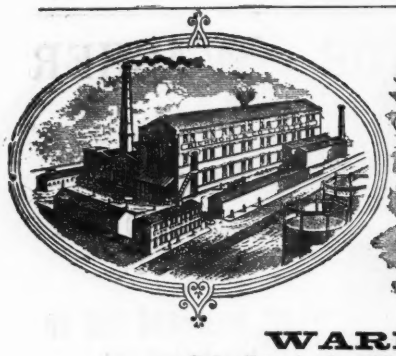


TWO-LIFT GASHOLDER, WITH TANK, WORKING WITH PEASE'S PATENT WIRE-ROPE SUPPORTS.

(From Photograph.)



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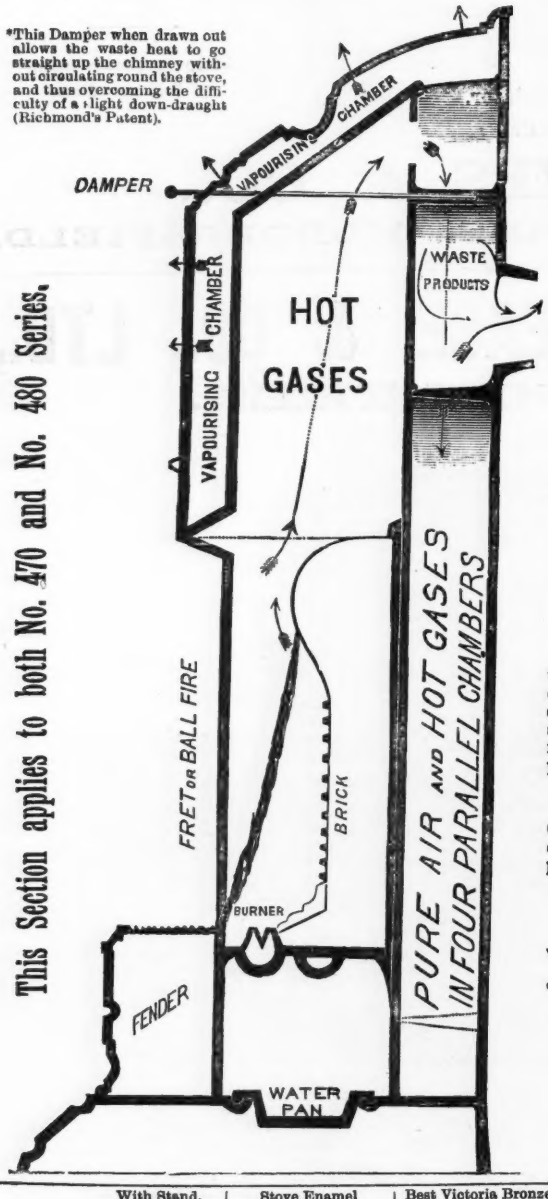

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472 Fret 1472 Ball	31½	21½	9	£2 15s	£6 13s.

	With Stand. High. In.	Wide. In.	Deep. In.	Stove Enamel Gold Relieved. Figures Bronzed.	Best Victoria Bronze with Stand, Water-Pan, and Damper.
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Make Stove very complete. Stand and Water-Pan, extra 8s. 6d. Richmond's Patent Damper, extra 4s. 6d.

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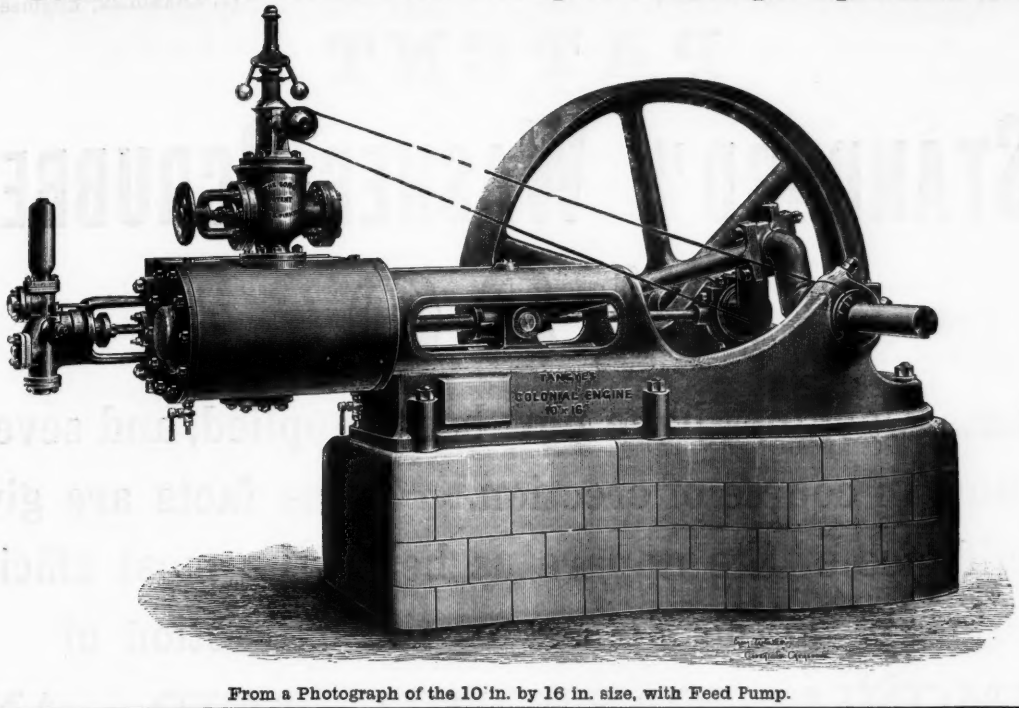
Constructed for Steam Pressures up to 100 lbs. per square inch.



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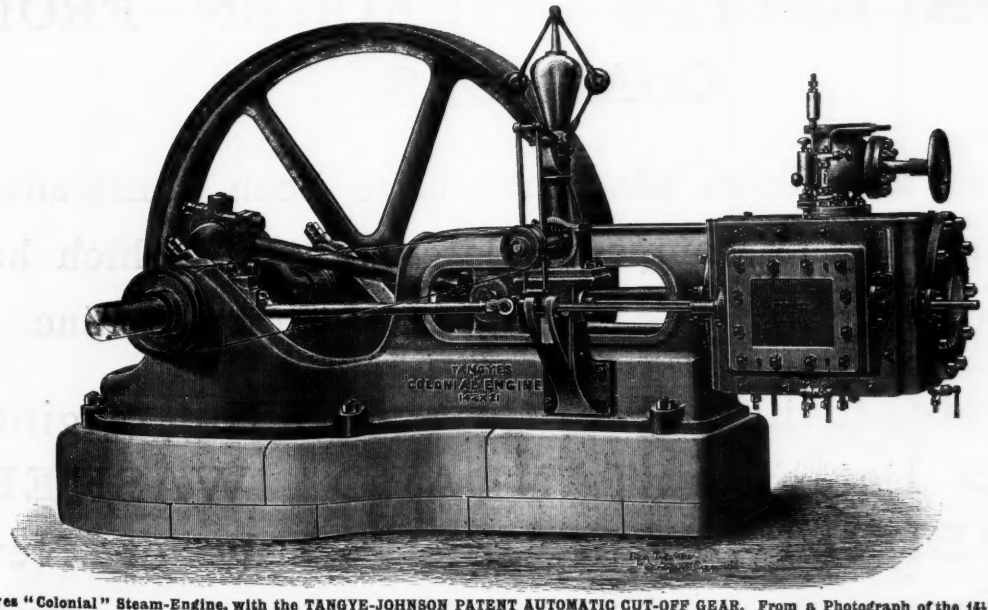
Steam Cylinder, diam. .. .. ins.	4½	5½	6½	7½	8	9	10	12	14½
Stroke, length .. .. .. "	7	8	9	9	12	14	16	18	21
Revolutions .. .. per min.	250	225	200	200	150	140	125	116	100



Tangyes "Colonial" Steam-Engine, with the TANGYE-JOHNSON PATENT AUTOMATIC CUT-OFF GEAR. From a Photograph of the 14½ in. by 21 in. size.

Steam Cylinder, diam. .. .. ins.	8	9	10	12	14½
Stroke, length .. .. "	12	14	16	18	21
Revolutions .. .. .. per min.	150	140	125	116	100

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430

of these Machines have now been supplied, and several are now in course of erection. These facts are given as evidence of the apparatus being the most efficient of any in the Market for the extraction of

AMMONIA, CARBONIC ACID, AND SULPHURETTED HYDROGEN FROM COAL GAS.

50 of the above Machines have been constructed according to the Company's latest Patent, which has also been applied to **25** original pattern Machines.

Estimates furnished for Cost of altering original pattern Patent "STANDARD" WASHER-SCRUBBERS, or for the supply of New Machines, on application at the Company's Offices,

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Meter in Cast-Iron Case.

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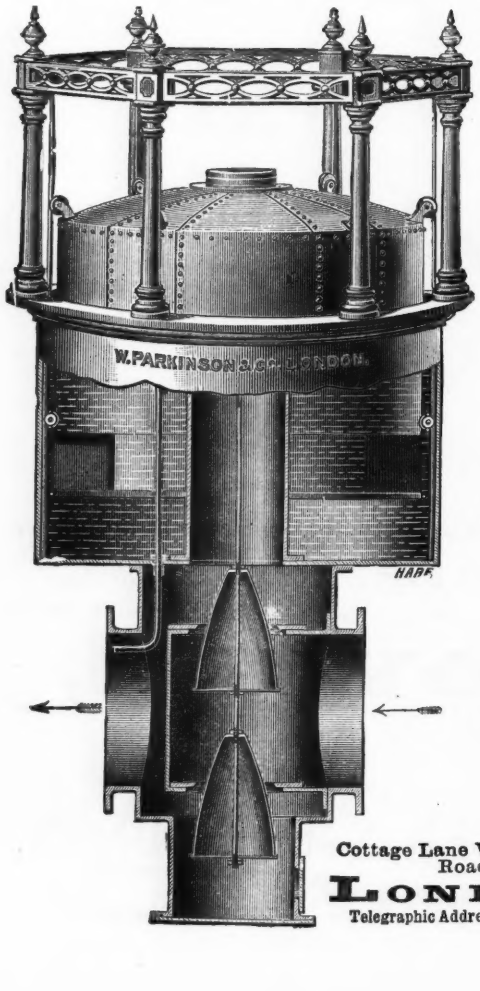
10th—Will not cost more than one-half for repair that Wet or Water Meters do.

Are upheld for five years without charge.



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A very large number are now at work; and all Engineers who have adopted them speak in unqualified terms of their great efficiency.

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TWO, FOUR, or SIX COLUMNS and GIRDERS.
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[See also Advt., p. 92.]

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NOTICE TO SUBSCRIBERS

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 12, 1892.

Technical Societies and their Methods.

THE appearance of the Transactions of The Gas Institute for 1891, and the non-appearance as yet of the book which may be supposed to be in preparation for the purpose of worthily recording the proceedings of the first meeting of the Institution of Gas Engineers, constitute two reasons for devoting a little consideration to the general subject of the reporting of the papers and discussions which supply one of the chief reasons for the existence of technical and scientific Societies. The same subject, curiously enough, is also discussed in the current number of our contemporary the *Electrician*. It is not going out of the way to remark that this matter of the publication of "Transactions" of Societies of the character of those in which our contemporary and ourselves are most nearly interested, is something that calls for particular attention from those who are concerned for the continued prosperity and welfare of these organizations. The notion that every respectable body of the kind ought to publish its own annual report, is an idea that belongs distinctly to the order of conventional, or traditional, opinions; and all such opinions ought from time to time to be overhauled and corrected up to date. There are good reasons why this should be done in regard to the publication of Transactions, because such publication always constitutes a heavy tax upon the resources of the organizations which follow the practice; and it must often have occurred to members of these bodies that there is a great waste of money in this respect. It never seems to occur to the authorities of technical Societies to consider their procedure in this matter from a rational common-sense point of view, in order to satisfy themselves, as men of business, whether the publication of Transactions is necessary or desirable, taking every case upon its merits; or, if this question is answered in the affirmative, how the publication can be best arranged for, and at the lowest cost. Every Society must be a rule for itself in this matter; because the resources, needs, and circumstances of no two bodies are alike. It is perfectly reasonable and natural that a Society should like to preserve a permanent record of what is said, written, and done under its auspices; but how this is to be accomplished, and the form the record should take, are greatly affected by circumstances. When the Society meets frequently, the best form in which its Transactions can be cast is that of a "Journal;" and this is the method adopted by the Society of Arts, the Society of Chemical Industry, the Chemical Society, and others. Some organizations, such as the Institution of Civil Engineers, produce quarterly volumes of reports of their proceedings. Others, however, like The Gas Institute, publish Annual Transactions. Publications of this nature, again, exhibit one striking line of distinction among themselves, which refers to their matter, and not to the period of their appearance: Either they are strictly and solely reports of the proceedings of the Society which publishes them, or they also comprise collected information relating to the subject-matter with which the name of the Society is identified. Obviously, the preparation and production of a volume of the latter class is a different business altogether from, and depends upon a different order of sanctions to, those which govern the publication of a mere report. The question whether a Society shall undertake the issue of one or the other kind of Transactions depends upon many considerations, and not least upon the existence or absence of a need for a record of any particular class of matter. It would be superfluous for a Society to undertake work that is performed by other means; yet that is precisely what is done in some instances, to the neglect of necessary tasks.

Let us explain. Supposing that a technical Society is devoted to acause in which no newspaper takes an interest, and which has no special journal to represent its current developments. In such a case—hardly conceivable, indeed, in this age of swarming hebdomadal publications—it would be necessary for the Society to draw up its own report and publish it, independently of all other appeals to a pre-occupied public. But when a Society cultivates a department of industry which is well represented by more than one special journal, and when these journals, for their own purposes, take good care to acquaint the world with what the Society does every time it meets, where is the sense in doing the work over again—after it has all "gone cold"—at the trouble and expense of the Society, and laboriously publishing a volume of Transactions ever so late in the day? "Ah! but," we shall be told, "no really respectable Society can take for a satisfactory report of its proceedings just what an editor of a technical journal sees fit to give. The authoritative report must be fuller, it must be corrected, and much must be included in the Transactions in the shape of plates of illustrations, diagrams, &c., which an editor of a weekly paper would not think it worth his while to reproduce." This observation is perfectly just; but it is not the less certain that, by a little sensible pre-arrangement in the majority of cases, a great deal of wasteful repetition in publication might be prevented. Plans, &c., must, of course, be reproduced in authoritative Transactions much more fully than they can be, as a rule, in a weekly paper, or the latter would usurp the office of the former altogether. But apart from this consideration, the official report is rarely so much better than that given by a good technical journal as to warrant the exorbitant

cost at which it is usually prepared. Why could not the Council of an Institution give it out before a meeting that they are prepared to adopt, as the basis of their official report, the best rendering given by the attendant press? They would secure every possible attention; procure better reports; and save much money. Some bodies of the kind will not do this because, forsooth, it would be "undignified," or more often because they are afraid that some rubbishy print will accuse them of "favouritism." Foolishness of this kind leads to waste of money, which is no great harm where cash is plentiful; but it sometimes happens that the best interests of struggling Societies suffer from the prevalence of absurd ideas respecting ways and means of publication, as well as lack of backbone, in their administrators. And after all is said, it often happens that the most piquant and instructive portions of the proceedings of technical Societies never appear in the formal Transactions at all, but only occur as criticism and correspondence in those journals which it is the preposterous cue of Institution managers to affect to distain.

Apart altogether from the question of reporting transactions, however, there is another aspect of the general subject of the utility of technical Societies, which is the point enlarged upon at the present time by the *Electrician*. It refers to the prodigious number of papers, articles, and technical matter generally which the Societies, the patent offices, and the journals of the civilized world continually pour out ostensibly for the instruction, but really for the bewilderment, of professional men. "Things have already come to such a pass, that it is almost impossible for anyone to read more than a fraction of the literature referring to his own special class of work; and science is spreading so rapidly that in the near future matters may be expected to be much worse." The need, therefore, has arisen for clear and concise abstracts of every special class of publications, to serve for reference. It is unnecessary to prove at length how desirable such abstracts, if only in the form of what the French call a *catalogue raisonnée*, would be in the gas industry. "The scientific Societies could do much to forward this work, either singly or in combination. We have already pointed out that the technical press has relieved these bodies of the need of publishing results, and the aim of Societies should now rather be the discussion of papers which have *not* been read before them, than, as too often happens, the reading of papers at such length that no time is left for discussion. The *raison d'être* of all Societies and similar Institutions is the bringing together of 'birds of a feather' for the critical examination of new devices, discoveries, and theories, and the collection and editing of scattered scientific memoirs." With these observations we heartily agree; and we think that the sooner our several Gas Engineering Societies put themselves abreast of the times, and, discarding mere conventionalities of use and wont, which have outlived any useful purpose they ever served, set their machinery to do good and necessary work, the better they will deserve of their patrons, members, and supporters. At present, it is certainly open to be said that they get very little in return for their outlay.

The Crystal Palace Electrical Exhibition.

Last Saturday was fixed for the opening of the Crystal Palace Electrical Exhibition, for which extensive preparations have been in progress during several weeks past. There will, of course, be many points of difference between the exhibits now or shortly to be visible at the Crystal Palace and those which occupied the same place ten years ago; but it is by no means certain that those differences will be either as remarkable, or as important, from the popular point of view as the ordinary public will be likely to expect. Visitors to the Crystal Palace will still see a lot of hissing, reeking steam-boilers. Nobody can truthfully pretend that the Davey-Paxman boiler plant of 1882 was not every whit as good as anything of the kind that can be bought to-day. It is the same with the steam-engines. The same types of generators will be seen driving (apparently) the same snapping, sparking, buzzing dynamos; and the uninstructed public will fail to mark any radical difference between the general aspect of this and the last Electrical Exhibition. Moreover, there have been plenty of electrical exhibitions, of a sort, since 1882. Not one of the popular shows held at South Kensington or at Chelsea has been without its electric lighting section. There is reason for supposing that strong partizans of the electric lighting industry cherish the delusion that the boilers and steam-engines and dynamos which have been so much in evidence at these displays were admired by the people who attended them as a means of amusement; but it is tolerably certain that even of the pleasure seekers at these places who admired the electric lighting itself, very few regarded the generating plant as other than a nuisance. We shall probably be quite safe in asserting that of the thousands of people who will stroll through the parts of the Crystal Palace appropriated for the present exhibition, during the time that it remains open, very many will be disappointed to learn that dirty boilers and humming steam-engines are still absolutely necessary adjuncts to the production of electricity on the large scale. From time to time one hears a good deal of vague talk about electricity superseding steam as a motive power. The general public really look for this, as an advance in modern material civilization. Whenever they hear of electrically-driven trains, and of electro-motors for various purposes, the popular notion unquestionably is that, in some unexplained way, electricity is to take the place of steam as a motive power; and when it is seen at the Crystal Palace that nothing of the kind is within the range of possibility, the popular feeling will be that the main thing about electrical generation stands just where it did ten years ago—which is perfectly true. There are to be plenty of gas-engines at the Crystal Palace; and the slower speed at which dynamos are now driven, as compared with similar machines ten years ago, will betray itself in other modifications of driving apparatus. The freedom with which incandescent electric lamps are now used for decorative purposes will also be noticeable in this display; and there will be much upholstery and ornamental interior lighting. Altogether, it is to be supposed the exhibition will be worth seeing; and we shall take good care to acquaint our readers with everything instructive that may transpire in regard to it. But there is nothing as yet to show that it will greatly impress the public with its evidence of the improvement in electric lighting *technique* since 1882. It will, of course, be clear that the business has grown; but we are by no means inclined to think that public opinion will hold that it is materially better in its methods or its results than it was ten years ago.

A Question of Hygrometry.

An interesting little discussion took place last month, in the correspondence columns of *The Times*, upon the question whether burning gas in a room tends to dry or to wet the walls. One of the disputants consulted Mr. A. Vernon Harcourt on the subject, "as there is no higher authority where any matters relating to the combustion of gas are concerned;" and the verdict was "that, in a room with no provision for ventilation beyond a chimney with no fire burning, and on a still, cold day, the burning of gas in the room is more likely to have a wetting than a drying effect." On the other hand, when there is a current of air through the room, Mr. Vernon Harcourt "has no doubt that the drying effects would exceed the wetting." Upon this head it may be remarked that the experience of shop-front designers is fairly conclusive. The glass of a window is a capital indicator of the condition of the air as regards moisture. In the case of a shop, which is an apartment having the whole of one side as a window, the condition of this large surface of glass, whether clean and dry or blurred and opaque with condensed moisture, is a matter of great importance to the proprietor. It is worse than useless for the shopkeeper to keep open, and burn gas with a view to attracting custom, if nobody can see through the window. And it is certain that, unless the shop is properly ventilated, lighting the gas will so increase the humidity of the enclosed atmosphere as to render the obscuration of the window by condensed moisture a question of a very few minutes when the outside temperature is low. The shop-front builder usually gets over the difficulty by arranging for ventilation along the whole length of the window—inserting a sort of open-work frieze immediately above the glass; and this, as a rule, has the desired effect. It is not that the gas produces by burning all the steam that appears condensed upon the window. Gas makes so little water, that any other method of lighting which raised the interior temperature without involving the combustion of hydrogen would produce practically the same effect. The result of steaming the glass is due

mainly to the fact that the temperature of the enclosed air is raised by the lighting agents, be they gas or anything else, and it therefore absorbs moisture from every available source, only to deposit it again when chilled by contact with a cold surface like that of the inside of a glass window. Thus we arrive at the somewhat paradoxical conclusion that it is really the drying—*i.e.*, the moisture-absorbing—capacity of the air of a gas-lighted room which is responsible for the streaming damp seen inside a closed window, or on a chilly wall, some time after the gas has been burning, and the ventilation has been insufficient.

The Weakness of the Labour Party.

THE attempts of a certain class of professional agitators to create a strong Labour Party, which should make its influence felt at the next general parliamentary election, and should also secure a share of representation upon all elective local governing authorities, are bound to fail while so many of the wire-pullers are at cross purposes. It has been repeatedly pointed out in these columns that a Labour Party, honestly and intelligently conducted by men of character and insight, might be expected to play a very useful part in the effort which we are all in our various degrees making to the best of our ability—the effort to leave the world better than we found it. Unfortunately, the first thing that a professional labour agitator thinks it his duty to do, is to set himself up in business as the only fountain of wisdom and tower of strength for those whom he designs to convert into his supporters. The new "leader" clambers into notoriety over the shoulders of the crowd; and, to begin with, he is content to play second fiddle to the recognized star performers. It is not long, however, before he essays a leading part on his own account. Anything which will ensure him a little individual prominence serves him for an opportunity—a successful strike, a conflict with the police, a right-of-way case, or a question of "intimidation." Active participation in a little noisy performance of this nature, especially if attended with some cheap martyrdom, gives the budding agitator a sort of claim upon the managers of the Trade Union "fake;" and when the individual is next heard of, he is perhaps an assistant-secretary, a paid organizer, or something of the kind in connection with a new Union, with nothing to do but "spout." After he has passed a certain point in the agitator's career, the self-appointed "leader" wants a party all to himself. He narrowly scrutinizes the old lions of his hunting-ground, and passes much of his time in weighing the chances of an attack upon the positions of such as appear to him feeblest. He has no respect for the past of these veterans, and never loses an opportunity for undermining their influence and sapping their reputation in the present—all in order that he may occupy their place in the future. A recognized leader who has been at the head of his division of the Labour Party long enough to have earned the respect of the community at large, and to have seen the futility of some of the old nostrums so continually reappearing as wonderful new principles in the crude charters vaunted by the new-comers, is sure to be branded as old-fashioned and useless by those who fancy themselves in the line of succession to his dignities and emoluments. There is little mutual confidence among the horde of agitators, and few of them would not sell their rivals at slight provocation. This is the main reason why the so-called Labour Party has so little coherence, and why the specific programmes of its professional counsellors make so little headway in popular elections, in comparison with the ordinary generalized party principles.

The Proposal to Place a Bust of Murdoch in the Wallace Monument at Stirling.—Our readers will doubtless remember that, at the annual meeting of the North British Association of Gas Managers last July, it was decided to apply to the Provost and Town Council of Stirling, as custodians of the Wallace Monument in that borough, for permission to place, among the worthies of Scotland therein represented, a bust of William Murdoch, the inventor of gas lighting. Accordingly, the Secretary and Treasurer of the Murdoch Memorial Committee of the Association (Mr. J. M'Gilchrist, of Dumbarton) has addressed a letter on the subject to the above authorities, accompanied by a statement setting forth Murdoch's claim to the honour solicited. Mr. M'Gilchrist points out that the next meeting of the Association, at which the centenary of the invention of gas lighting will be celebrated, is fixed to be held in Stirling in July next, provisionally on the permission now asked being granted; and occasion would then be taken to unveil the bust.

WATER AND SANITARY AFFAIRS.

THE address delivered at the meeting of the Balloon Society last Friday, by Mr. Harry Wilkins, the Vestry Clerk of St. James's, Westminster, of which a report will be found in our present number, was remarkable for the fact that, while dilating on the Metropolitan Water Question, it was not altogether unfair to the Water Companies. In saying this, we do not mean to imply that Mr. Wilkins is at any time wilfully unfair. That of which we complain is the general recklessness with which the water supply, and the Companies who furnish it, are attacked by public speakers and writers. We do not agree with all that Mr. Wilkins said or proposed; but the animus of his remarks was in no respect objectionable. He acknowledged that, on the whole, the London Water Supply was never in so satisfactory a state as it is now; yet he had the idea that the inhabitants would be better served if the undertakings were in the hands of a public authority. The argument is one which reminds us very much of the epitaph: "I was "well; I would be better; and here I am." Admitting it as conceivable that the water supply might be more advantageously conducted by a public authority than by the Companies, it must be acknowledged that there is just a risk the other way. Is London prepared to see the water supply handed over to the County Council? Is Mr. Wilkins himself desirous of seeing such a change? He objects to the Water Bill which the Council, under cover of the Corporation of the City of London, are going to bring forward in the coming session. In his opinion, it is rather worse in some of its features than the rejected City Bill of last year; and he regrets, in very expressive terms, that the Corporation have been induced to sacrifice their dignity in order to further the designs of the County Council. Mr. Wilkins would prefer, as the Water Authority, a federation of the Municipal and County Councils of Greater London, with the Corporation of London at the head. He also objects to the notion of drawing a supply from some distant source, and is in favour of Sir Robert Rawlinson's plan for the establishment of adequate storeage reservoirs in the basin of the Thames. Accordingly, Mr. Wilkins sets aside the London County Council and their schemes for fetching water from Mid-Wales or Devonshire. Mr. Wilkins might also perceive that while there is no need to go to remote mountains or lakes in order to supply water to London, so in like manner the existing Water Companies are quite equal to the task of making the extra storeage reservoirs in the Valley of the Thames. If it were necessary, they could go farther; but they are not disposed to fling away the money of the shareholders, in extravagant projects based on Utopian conceits. Perhaps the County Council also intend nothing of the kind; but they talk as if they did, and expect to be looked upon as very "progressive" and enlightened in consequence. The resolution adopted by the meeting at the close of Mr. Wilkins's address was a very proper one, presuming it to be certain that London would be benefited by the transfer of the supply to a public authority. As the first step towards the change, it was agreed that the present undertakings should be purchased "on equitable "terms." This again is at entire variance with the policy of the County Council. With them, such purchase is the last thing, even if it comes to pass at all. But what are "equitable terms?" On this point Mr. Wilkins is not quite so clear as we could wish. This is certain, that if a shareholder is to lose part of his annual income, the bargain is not fair to him, let the calculation be ever so ingenious. Mr. Wilkins defends the lost Bill of the Vestries, which included a scheme of arbitration. But even that may be framed unfairly; and Mr. Wilkins admits that the opposition of the Companies was intelligible, while in his opinion the antagonism of the County Council to the arbitration clause was incomprehensible and inconsistent. However, Mr. Wilkins need not have been surprised, especially as the Water Trust were to proceed to purchase within two years after the passing of the Act. If the "equitable" only were intended, there would be a royal road to the end of this question, but—as suggested on a former occasion—the "if" is a big one.

The watershed question, to which we have often adverted, is the subject of a communication addressed to the Chief Inspector of Fisheries by the Chairman of the Severn Fishery Board. Although forwarded to this latter authority, the terms of the application are not limited to

any one interest, but comprehend all rights and parties that are in any way affected by the appropriation of water for outside purposes. The scheme of the Birmingham Corporation, to take some of the head waters of the Wye, is the immediate cause of the document being drawn up; but regard is also had to the different proposals that are being made from time to time "to take water out of one "watershed area, for the benefit of a place outside the "watershed." The Severn Fishery Board have arrived at the conclusion that the time has come for the Board of Trade, or some Government Department, or for Parliament by means of a Standing Order, to lay down certain general rules that should apply to all such cases, so as to define the terms under which an outside authority is to be entitled to abstract water from a watershed. It is remarked that, although the abstraction is based on public grounds, the promoters of these water schemes are seeking to acquire very valuable rights, from which they will obtain a large revenue, while making compensation to only a few of the parties prejudiced by such a proceeding. The water of the Wye is a very valuable property to the City of Hereford, and to various towns and persons on the banks of the stream; but if the Birmingham Bill becomes law, all these will suffer damage, without any opportunity being offered them of defending their interests. A suggestion now emanates from the Severn Fishery Board, that the appearance of the Birmingham Bill should be made the occasion to lay down authoritatively the conditions under which water may be diverted from its natural area. The Chairman of the Board, on his own responsibility, suggests certain details to be comprehended in the regulations. The first proposal seems to be eminently reasonable—that the promoters of a scheme should only be entitled to take the surplus water of another area. This is important both ways. A foolish cry has been raised, that the Welsh rivers are for Wales. Primarily they are so; but not absolutely and entirely. That which Wales does not want, may fairly be given to those districts which are in need. How to estimate the surplus water is a question which may involve some research and trouble; but clearly the principle at stake is a right one. The mode of providing compensation water is also to be dealt with; and embraces several particulars. The rules throughout are only to apply to promoters "coming out of their own district to "take water from another district." The principle has long ago been recognized; but the present proposal is to embody it in a well-defined code, so that the whole question should not have to be threshed out over each particular Bill. The subject will come up for further consideration at a meeting of the Severn Fishery Board to be held in Birmingham in the course of the next few days. We trust we may take this as the beginning of a serious attempt to grapple with a question which is becoming of increasing importance every day, and which attracted attention as far back as the date of the Royal Commission on Water Supply, which reported in 1869.

The Bituminous Coal of Japan.—At one of the recent meetings of the London Section of the Society of Chemical Industry, Mr. Watson Smith read a paper entitled, "A Contribution to our Knowledge of the Soluble and Resinoid Constituents of Bituminous Coals," in which he dealt chiefly with the composition of the Miike coal of Japan. Although large quantities of this coal exist in Japan, its value for the manufacture of gas, tar, and residuals has not yet been demonstrated. The author has had an opportunity of examining this coal; and he finds it very rich in bituminous constituents. By means of a model gas-making plant, he has been able to ascertain the yield of gas, tar, and residuals which an average sample of the coal would furnish; and the coke obtained is very hard and suitable for blast-furnace work. Although he gave in his paper the quantity of sulphur present in the coal, he has not yet made an analysis of the coke; but he intends to investigate this point, and thus determine the value of the coke for other kinds of metallurgical work. The yield of sulphate of ammonia from the experimental plant shows that, if the coal were converted into coke, the salt obtained would form an important source of revenue as a fertilizer. The tar has been fractionated, and the relative amounts of phenols and light and heavy oils ascertained; and from an examination of the soluble constituents of the coal, the author has demonstrated the presence of naphtha and paraffin scale in the bitumen. The Miike coal appears to be intermediate in character between the lignites and English cannel coals; and, although information on the geological nature of these beds is still wanting, the author pointed out that the large quantity of bitumen indicates its origin from a forest of coniferæ and spore-bearing trees.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 79.)

DESPITE the fair show of renewed activity which the Stock Markets made on the opening day of the New Year, business was rather dull during the past week. Still, there is a stronger disposition generally; and this is perhaps illustrated by the slight effect produced by two incidents, both occurring, by a strange coincidence, in the Dark Continent. A few months ago, the death of the Khedive and the looming of trouble near Gibraltar would have caused much greater disturbance. The Money Market continues in the same condition of ease. The Gas Market has been only moderately active; but the tendency to improve is still steadily marked, and all changes in quotation are in the upward direction. Gaslight "A" is 1½ better; but the last prices were not equal to the best of the week. A good share of business was done in the secured, preference, and limited issues at fair figures all round. The announcement not long hence of the dividend to be recommended for the past half year, is being awaited with interest; and some speculation is excited as to the rate at which it will be. The opinion expressed in some quarters is that, having regard to the large advance in the price of gas just made, which has evoked much unfavourable comment, and also to the fact that the dividend which may be declared next August cannot exceed 12 per cent., the wisest policy for the Company would be to come one step down now, and reduce the February dividend to 12½ per cent. In this opinion, we entirely coincide. Such a measure will, to an extent, relieve the reserve fund of the strain it must bear, and will, in the long run, have a healthy effect upon the position of Gaslight issues in the market. South Metropolitan "B" has moved along—quietly and steadily improving its position, and marking a further rise of 2. Commercials looked healthy, but made no move. Very little notice was taken of the Suburban and Provincial undertakings; but the few bargains noted were at very fair prices. Alliance and Dublin stocks were each ½ better. The Continental Companies are still very firm. The Union was the busiest, and the open stock advanced 5. Imperial advanced 2; but the transactions were very limited. Among the rest, the Indians had the best of it; and both Bombay issues rose ½. The Water Companies were very quiet; but the tendency to improved values was apparent by advances in a few quotations.

The daily operations were: Gas issues generally were strong at the opening on Monday, and everything dealt in went at good figures; but the only advances in quotation were a rise of 1 in South Metropolitan "B," and ½ in Imperial Continental. In Water, Kent rose 2½. Gas was quieter, but fully as firm on Tuesday, without any change in quotations. On Wednesday there were several advances scored. Gaslight "A" rose 2½; South Metropolitan "B," 1; Imperial Continental, 1½; and Continental Union, 5. Southwark Water rose 1. Quiet, steady business in Gas was the rule on Thursday; prices undergoing no alteration. In Water, both Southwark issues advanced 2. On Friday the Gas Market was not quite so firm, and Gaslight issues showed an easier tendency; but quotations held good. East London Water was in some demand, at a rise of 1. On Saturday, the tendency of the previous day was confirmed, and Gaslight "A" was lowered 1. The only other Company dealt in was South Metropolitan, which showed out firm. Water was quiet and unchanged.

ELECTRIC LIGHTING MEMORANDA.

The Comparative Cost of Electric and Gas Lighting—The Areas occupied by the Metropolitan Electric Lighting Companies—The Obstacles to the Progress of Electric Lighting in Residential Neighbourhoods—The First Electric Lighting Undertaking to be Acquired by a Municipality.

THE interesting little controversy respecting the cost of electric lighting, which we mentioned last week as having been started in the correspondence columns of the *Financial News*, has been continued long enough to serve the useful purpose of confirming the general impression that electric lighting, as actually supplied by the London central station companies, costs the user about three times as much as gas. Whether it is even then quite as efficient, remains a matter upon which some difference of opinion exists. Messrs. Crompton and Co. took part in the discussion, with a view to making public the essential difference between their system of supply and that of the House-to-House Company. The Crompton system is that of the Kensington and Knightsbridge, the Notting Hill, and the Westminster Companies; and in regard to it the contractors declare that "the actual consumer's bill is not greatly in excess of his previous gas bill." They do not say, however, whether the same consumers have or have not still a gas bill as part of their expenses for light, which we fancy is generally the case. The Manager of the House-to-House Company did not like his system of supply to be disparaged by a partisan of another method; and he accordingly wrote to point out that since the charge per unit to the consumer is exactly equal in his Company's district and in those cited by Messrs. Crompton and Co., any comparison with gas which holds good in the one must also apply to the others. Messrs. Crompton and Co. have not been able to contest this

point; and so they fall back upon the argument that, taking the cost of raw material, wear and tear of machines, and manufacturing wages, as representing the "sheer cost" of electricity, this would be as low as, if not lower than, that of gas, if the production of both commodities were reckoned for in sufficient quantity to supply (say) two square miles of London. Meanwhile, the discontented consumer who started the controversy is satisfied to compare the cost of electric lighting, as a commodity, with that of gas; and he declares that the two costs are as three to one. Whether the "sheer cost" of electricity is more or less than that of gas at the works, is a question with which the consumer has nothing to do. All he looks at is the amount of his bill. The London Companies mentioned in this correspondence charge 8d. per unit for their supplies; and when a subscriber, after paying this rate, finds it in him to state that "the light for working and reading compares unfavourably with gas," it is easy to understand why the companies' business is not of a more flourishing character.

Our contemporary the *Electrician* naturally takes a deep interest in the fortunes and the progress of the London electricity supply companies, and is bringing out a map of the different districts covered by these organizations, which is to be accompanied by some statistical information relating to the working capabilities of the undertakings. We gather from the preliminary statements of our contemporary respecting this proposed publication, that the Company having the largest net area for development is the Metropolitan, with 4·6 square miles. Next comes the London, with 3·37 square miles; the Westminster, with 1·9 square miles; and the Chelsea, with 1·13 square miles; None of the others covers a mile; and the bright and shining exemplar of the electric lighting interest in Great Britain—the St. James's and Pall Mall Company, to which reference is always made in prospectuses, after-dinner orations, and on all other occasions when the commercial success of electric lighting is advertised—occupies a district not more than 0·24 square mile in extent! It has for the supply of this district plant capacity for 40,000 lamps, which is after the rate of 167,000 lamps per square mile. If this is the scale of business upon which alone the supply of elec tric lighting can be said to pay, where is such another instance to be found? The two largest Companies—the Metropolitan and the London—have each a plant capacity of about 21,000 lamps per square mile. What a difference is here!

It is remarked that "the spread of electric lighting in residential districts is largely impeded by the uncertain and short tenure of house property." During 1889, about 100 miles of cable were laid in front of some of the best houses in London; but 90 per cent. of these are not wired, nor are they likely to be, until the termination of the existing leases. Expressed in another way, the expense of wiring a good house for electric lighting is so great that even many of the "best people," who could otherwise afford to patronize the supply companies, regard it as a hazardous outlay when the premises do not happen to be their own property, or when their enjoyment of them is not likely to be prolonged over a considerable period. In so many ways does the costliness of electric lighting war against its prospects of success! The fact of this difficulty having arisen illustrates once more, and in a very striking way, the radical difference between the circumstances of the electric light industry in America and in England, which renders all arguments from one to the other so futile and misleading. In North America there is no doubt that electric lighting, of a sort, has spread like wildfire; but it is supremely ridiculous to say that this is because, in some mysterious sense, the people there are more "advanced" or "go-ahead" than the inhabitants of the United Kingdom. This explanation may be good enough for a cheap evening newspaper; but it will not satisfy the least alert critical faculty. In the United States, electric lighting companies are scratch concerns, tied to the larger manufacturing companies which exploit particular "systems." They get their plant upon credit, or in exchange for "bonds," taken at a heavy discount, and they scrape together a connection anyhow, doing the indoor as well as the outdoor work, all of which is usually of the cheapest and most trashy character. It is comparatively nothing to wire and light a "city" of frame-built shanties, bordering unpaved roadways, where the side walks are planked, and posts and wires along all frontages are not objected to. Contrast this sort of thing with the standard of work required in a Piccadilly or a Park Lane mansion, and no further explanation is needed of the fact that American practice is no guide to the English trade in electric lighting.

The contemplated purchase of the city electric lighting undertaking of Messrs. Muir, Main, and Coulson by the Corporation of Glasgow for the respectable sum of £15,000 is the first transaction of the kind. It is not likely to have many followers; the circumstances being quite unique. It was the odd case of a firm going into an electric lighting speculation for what could be made out of it, without obtaining statutory rights or any sort of sanction save the commercial one. It was, in effect, a reproduction in Glasgow of the same class of venture that Sir Coutts Lindsay started at the Grosvenor Gallery in Bond Street. The Glasgow speculators managed to secure some paying contracts, including the lighting of the Post Office, and went on working, while the Corporation were thinking and talking about obtaining a Provisional Order. The firm were careful to observe the Board of Trade stipulations respecting overhead wires; so that when the Corporation had finally made up their minds to go into electric lighting for themselves, they found these enterprising people in possession of a snug little connection with which their Order gave them no right to interfere. Negotiations followed, and the electricians asked the modest sum of £30,000 to turn out, or rather more than double what their business was really worth. After a valuation, the Corporation offered the firm £15,000, which has been accepted; and Messrs. Muir, Main, and Coulson occupy the proud position of being the only founders of an electric lighting business which a municipal corporation have deemed it worth their while to acquire on any terms.

THE LITERATURE OF THE LAST FOG.

THE exceptionally dense, dark, and prolonged fog which settled down over London during the early part of Christmas week has already been mentioned in the JOURNAL; but it is well perhaps to return to the subject, for the purpose of placing upon record a synopsis of the popular contributions to the literature of the visitation, in the shape of the numerous and voluminous letters to the newspapers, &c., of which there has been a remarkably heavy crop. Whenever there is a recurrence of such a "London particular," as Dickens has described in the opening chapter of "Bleak House," the newspapers for days afterwards exhibit a varying amount of "fog matter" in the columns devoted to editorial articles, correspondence, and inquests. This time the discussion of the fog in the columns of *The Times* has been specially full; and though the writers who participated in this outburst of complaining against the Londoner's traditional horror almost to a man admit the futility of protesting against what appears to be inevitable, it is desirable to sift this mass of newspaper writing, so as to collect any novelties of suggestion or of criticism which may occur in this latest addition to the literature of London fogs.

The discussion of the subject in *The Times* was opened by the Dean of St. Paul's, with a complaint against the County Council for not lighting up the Thames Embankment during the fog; and in the same issue of the paper Dr. Balmanno Squire implored the Editor to "put a little pressure on the gas companies that they in turn may put a little pressure on the gas." This writer stated that on a foggy day "everyone turns on the gas, which indeed is needed far more than at average night time." But he went on to aver that the gas companies do not recognize fogs—"they only recognize day and night." A few days later, the same gentleman again wrote to compliment the Editor of *The Times* upon the imaginary consequence of putting the "tremendous weight" of the paper upon the gasholders, which he innocently supposed to have been instrumental in causing a good supply to be given on Christmas Day. This gentleman's ideas are scarcely creditable to the average intelligence of the age in which we live. They serve to show, however, the character of the damages suffered by gas companies from prolonged fogs. They are held up to execration as rich monopolists who require to be stirred up by newspaper editors before they will take advantage of the opportunity given by foggy days for selling more gas than usual. It does not occur to the people who make this charge of supineness against the companies, to blame their brewers in the same way for not sending out beer, or their coal merchants for failing to deliver coal, when fogs render roadways impassable. Yet it would be difficult to maintain the proposition that gas companies ought to be superior to all climatic influences. The fact remains, however, that, in times of fog and frost, every gas consumer thinks only for himself. It is nothing to him that the company are sending out double their average quantity of gas; this is their affair. He wants all the gas he can get; and if he experiences any difficulty in obtaining enough, he abuses the company, and inclines to the belief that electric light may be more satisfactory—simply because he has had no experience of it. He is shy of declaring a preference for oil, because it is not always possible to have the can filled; and the inconvenience is just as great when the boy from the oil-shop cannot find his way to the house, as it is when the gas company cannot keep up the full pressure in their mains.

The discussion of the fog itself speedily occupied the attention of the readers of *The Times*, to the exclusion of complaints against the London Gas Companies. One correspondent described how he had left London "shrouded in the chimerean [*sic*] darkness of fog," and had arrived in Paris the same day to find the atmosphere of the French capital so "intensely pure," that it was quite a pleasure to be in the open air. The difference he ascribed to the use in Paris of anthracite coal and wood. Another correspondent—Mr. J. A. Timmis—corroborates this evidence; reporting that although the use of open fires has extended very largely in Paris of late years, and is increasing, the chimneys remain comparatively smokeless, owing to the preference of Parisians for coke, anthracite, and wood, instead of bituminous fuel. It is admitted that wood is out of the question in the case of London; but Mr. Timmis asserts that both anthracite and coke are more easy to obtain in London that in Paris, which is probably true. His remedy for the fog trouble is that a Committee of the London County Council should consider how the general consumption of coke

and anthracite can be promoted. The inevitable *dilettante* of the Smoke Abatement variety, of course, came to the fore. Dr. Wyld, who has been heard occasionally, we fancy, at The Gaslight and Coke Company's meetings, wrote to say that thirty years' study of the subject has led him to the conclusion that "the only cure is the compulsory use of smokeless fuel—that is, hard coal, coke, or gas." He also states that, having built a house with fire-brick grates, he burns in these smokeless Welsh steam coal "with perfect ease and satisfaction."

Mr. Young, a member of the Institution of Civil Engineers, wrote to advocate the supplying of air directly to fire-places by means of a pipe through the wall; although how this is to obviate fog is not so apparent as could be wished. Another gentlemen proposes that, in the next Bill dealing with the Metropolitan Buildings Acts, a few clauses drawn up by "the County Council and the Institutes of Architects and Surveyors" should be inserted, prescribing the proper construction of flues and the character of fire-grates for all future buildings. A Mr. George Herring joins in the cry of "stupidity" raised against all who do not burn anthracite in preference to bituminous coal; and he declares that the former variety of fuel "throws out more heat, is free from dust or dirt, is smokeless, and cheaper than the latter." If this is so, then the failure of anthracite to establish itself as the favourite fuel of the English householders ought to be put down to pure "cussedness" on the part of the latter; but it is difficult to accept this explanation. A correspondent wrote to recommend the well-known device of lighting fires from the top; but the weakness of this remedy lies in the fact that, sooner or later, fresh fuel must be added, and the whole thing demands a degree of forethought and carefulness in the executants, that cannot be attained by the ordinary domestic servant.

At this stage of the discussion, Dr. Alfred Carpenter, one of the founders of the Smoke Abatement Institution, came forward with a truly remarkable letter. In this communication, he repeated an old suggestion of his that all fire-places not consuming their own smoke, or not constructed for the use of smokeless fuel, should be taxed; the produce of such tax to be devoted to the reduction of the sanitary rate, or to providing "a fund for dealing with the right principle of sewage utilization," the effect of which would, in his estimation, be that in "ten years' time London would be entirely freed from its black and yellow fogs." Householders who still preferred the luxury of a pokeable, blazing fire would have to pay for their enjoyment. Dr. Carpenter, moreover, had something to say about gas supply. He delivered himself of the profound opinion that the deficient supply of gas in foggy weather is not due, as mere common people hold, to want of pressure at the works, but to the action of cold upon the gas in the mains. "The cold causes a condensation of cholesterine wherever the pipes approach too near the surface of the earth. This material is one of the great sources of illuminating power. The loss of it causes loss of luminosity in the gas, and at the same time, by diminishing its calibre, impedes its progress along the pipes. This separation," the learned expositor continues, "becomes easier in consequence of the companies trying to obtain more gas than they should from each ton of coal. If they were satisfied with 8000 cubic feet per ton, instead of trying to get much larger quantities, the gas would not be so easily acted upon by severe cold." The individual who wrote this farago of pedantic nonsense dated his letter from Ventnor; but it should have originated in the Isle of Laputa. What does Dr. Carpenter mean by his "cholesterine," and his "diminution of calibre?" The experienced gas manager may laugh at his fantastic attempted explanation of the obvious consequence of endeavours to make short stocks of gas hold out through excessive strain; but it is pitiable that such trash should be heard outside the "Mudfog Papers." Dr. Carpenter also advises gas companies to sell gas at 2s. per 1000 cubic feet, which, he thinks, will be easily accomplished "if they will meet the matter in a proper spirit, and save themselves from the downfall which tremendous dividends and wasteful expenditure are hastening forward." This is a sensible comment upon the state of things revealed by the last advance of The Gaslight and Coke Company!

Poor Dr. Carpenter was heavily "slated" by later correspondents of *The Times* for what one critic called his "quackeries;" and, with regard to his grand taxation device, a correspondent declared that the public ought to "understand that any man who talks of curing fog by forcing any pattern of grate or furnace upon the people, is alike chemically and politically a charlatan." It is charitable to suppose that the term "cholesterine" seemed as satisfying to Dr. Carpenter as "that blessed word Mesopotamia" did to another old lady. But even so there is the difficulty about the "calibre" of gas, or the mains, which a fog is supposed, upon this authority, to bring into prominence. Consideration of these eccentricities of debate, however, is more entertaining than helpful; and so, when the general subject of fog and its prevention was treated editorially in *The Times*, the issue was carefully defined and rigidly investigated. There is no dispute as to the cause of the particular abomination known as London fog. We shall never render the air of London, with its clay basin traversed by a tidal river, so dry and free from fog as the air of Paris, which is built upon a subsoil of gypsum, and is far from the sea. The only question is whether the fogs of London can ever be freed from their artificial additions of solid carbon particles, tarry vapour envelopes, and sulphurous acid gas. Some worthy and public-spirited people claim that they can render their own houses smokeless by burning anthracite or coke; but even if this claim is justified—which would be a large concession to make—the cause is not much advanced thereby. "It is idle to say that what one man has done, others can do. So they can; but they won't." Then, how to make the backward ones fall into line? Tax their grates, say some enthusiasts. Nothing could be simpler, on paper, as *The Times* admits; but how would it work? If England were governed by the Czar of Russia, it is remarked, a ukase would long ago have been issued to put this matter straight. This happens to be a free country, however; and government *à la Russe* is one of those things which would probably be dear at the price of a few London fogs, even if it answered its purpose, which can hardly be taken for granted. Who are the County Councils, that they should be trusted with inquisitorial powers, whether for the suppression of fogs or of anything else, which would involve the inspection of every house, and the examination, testing, and certifying of every grate? "Every chimney from which smoke was seen to be issuing would be an invitation to the local inspector to pay a domiciliary visit. If the tax per grate were low, the householder would grumble and pay it, in order to save himself trouble and further expense. If it were high, it would provoke organized and inevitably successful resistance. The van and wheel tax was successfully resisted, though it affected only a limited class. The proposed hearth tax would affect every single householder in London. If this is the only way to get rid of London fogs, we must regretfully say that it seems to be hopelessly impracticable."

It is not argued that under no conceivable conditions could Londoners be expected to submit to such a hearth-tax as has been suggested. But the remedy is far too drastic to to be accepted, unless as the only reliable cure for a deadly evil; and matters have hardly yet arrived at that pass. Moreover, if we are to believe Mr. John Aitken, it is by no means certain that even smokeless combustion deprives the products of the operation of all their objectionable characteristics, though the most obvious of these might be no longer apparent. The net outcome of the recent newspaper discussion of the great fog question is, therefore, practically *nil*. No fresh suggestion for dealing with fogs has arisen out of this latest controversy, which has only shown once more that it is those who know least about the matter who profess to be readiest to take extreme measures for its treatment. The fact that as London and other English towns extend, so they grow more and more liable to fogs, illustrates the immensity of the field still awaiting full occupation by gas-kitcheners, gas-fires, and coke properly prepared for domestic consumption. Beyond this evident conclusion, all is uncertain. We do not see the remotest probability that the business of the bituminous coal merchants will suffer in our time at the hands or tongues of the Smoke Abatement advocates; and the only hope of converting the householder from persevering in making smoke himself, while anathematizing the smoky chimneys of others, is to convince him in detail that his own pocket will be favoured, and the convenience of his own domestic establishment will be served, by his patronizing gas and coke to the full extent of their capabilities for cooking his food and warming his dwelling.

Mr. Daniel Till, who constructed, and was until twelve years ago the Manager of, the Keswick Water-Works, died yesterday week. The deceased gentleman had attained his 64th year.

Mr. J. B. Fenwick, of the Windermere Gas-Works, was last Friday appointed Manager of the Retford Gas and Water Works. Mr. James Bailey, son of the ex-Manager, was selected to fill the office of cashier.

The Transactions of The Gas Institute.—We have been favoured by the Secretary of the Incorporated Gas Institute (Mr. W. H. Harvey, B.A.) with the volume of Transactions of the Institute for the past year—issued under his editorship.

Death of Dr. Bernays.—The death is announced of Dr. Albert J. Bernays, Professor of Chemistry at St. Thomas's Hospital, and Water Examiner to the Kent Water-Works Company. The deceased gentleman succumbed last Tuesday to an attack of bronchitis, after five days' illness, in his 69th year.

Death of Mr. Charles Heisch.—We regret to record the death, on the 2nd inst., at Brighton, in his 72nd year, of Mr. Charles Heisch, Gas Examiner to the Corporation of London. Mr. Heisch gained his early professional experience in the laboratories of the late Professor Phillips and Dr. Leeson, with the latter of whom he laid the foundation of his extensive knowledge of photometry and kindred subjects. He was for many years Lecturer on Chemistry in the Medical College of the Middlesex Hospital; but he resigned this appointment in 1876, in order to devote more time to the duties of the office of Corporation Gas Examiner, to which position he was elected by the Court of Common Council in 1869, in succession to the late Dr. Letheby, who became Chief Gas Examiner for the Metropolis, under the Board of Trade. Mr. Heisch was a skilled microscopist, as well as a very clever mechanician; and for some years he was the proprietor of the (at one time) well-known business of Messrs. Murray and Heath, opticians. His numerous contributions to the literature of the chemistry of gas manufacture and photometry are too well known to need recapitulation.

NOTES.

The Berthelot Calorimeter Cheapened.

At a recent meeting of the Académie des Sciences, M. Mahler communicated a statement respecting an improvement of the Berthelot calorimetric bomb, introduced by himself for the benefit of industrial workers in calorimetry. This instrument, as devised by M. Berthelot, is reputed to be the most satisfactory appliance of the kind known to science. It consists of a strong steel shell, lined with platinum, in which the combustible to be examined is burnt in an atmosphere of pure compressed oxygen. By this means the combustion effects of every description of fuel can be accurately determined and compared; and so delicate is the arrangement, that M. Berthelot has employed it with success in experiments of a physiological nature. M. Witz has employed the shell for the calorimetry of coals and gases; but the great drawback to the extended use of the apparatus has hitherto been its high cost, which ranges from £80 to £100, in consequence of the large quantity of platinum required in its construction. M. Mahler now claims to have overcome this difficulty by substituting a lining of a special kind of enamel for the platinum; by this means reducing the cost of the apparatus to about £4—at which it may well find its way into industrial laboratories and technical schools. The facility with which suitably compressed and pure oxygen can also be obtained, is an additional aid to the extension of the Berthelot method in calorimetry.

Healthfulness of Coal-Dust Laden Air.

Dr. S. Rideal has written to *Industries* on the subject of the alleged immunity of coal miners from consumption, with reference to statistics recently published by Dr. Bertillon in Paris, which confirm an opinion previously expressed by Dr. Ogle. These statistics go to show that the death-rate from consumption among coal miners is 43 per cent. less than that from this disease among all men at the same ages living at the same time. Although this seems a well-established fact in the case of coal mines, the statistics for other workers in dust-laden atmospheres tell a very different story. Dr. Rideal suggests that a possible explanation of the fact in question may lie in the presence of small quantities of hydrocarbons of the marsh gas series in air which is full of coal dust. It is well known that in America the neighbourhood of the oil wells is regarded as peculiarly healthy; and all classes of workers on board the tank steamers and in the oil industry are remarkable for their robust health. The conversion of hydrocarbons into fat may be a problem which, as Dr. Rideal says, cannot be readily solved in a chemical laboratory, but may be one which takes place in the human body, and would account for these phenomena. It is suggested than an inquiry into the vital statistics of other workers in coal, besides pitmen, might reveal interesting data bearing upon this subject. It is certain, for example, that coal trimmers and gas stokers are anything but the unhealthy members of the community which the dusty nature of their occupation would appear to indicate, if dust itself, without regard to its nature, is to be esteemed as detrimental to health. It seems probable, however, that the nature of dust is everything in respect of its effect upon the respiratory organs; so that a retort-house of a gas-works—where the air is occasionally so thick with coal dust that it is impossible to see from one end to the other, and the men's faces confess the condition of the atmosphere—is a salubrious resort in comparison with a clean-looking woollen warehouse or a flour-mill.

Test of a Pulsometer.

From a paper presented at a recent meeting of the American Society of Mechanical Engineers, it appears that Messrs. C. G. Atwater and Charles B. Hodges have made a test of a pulsometer pump, to serve for the "thesis work" required of the authors by the Stevens Institute of Technology. The machine tested was an ordinary one taken out of stock, and the object of the test was to ascertain its duty as a lifting pump under varying conditions. The suction and delivery pipes were each 4 inches in diameter, and the pulsometer was run as nearly as possible under ordinary working conditions. The water as pumped was received into a tank, whence it passed through a meter to the large tank from which the suction was taken. The steam-pipe was 1 inch in diameter, and was throttled about 2 feet from the pump. The consumption of steam was computed from the increase of temperature of the water in passing through the pump. The work was computed by means of pressure-gauges and the quantity of water lifted. The actual height of suction was 7 ft. 6 in.; the actual height of lift being 25 ft. 4 in. Four tests were made, with steam pressures varying from 19 lbs. to 43·8 lbs. No attempt was made to determine what pressure would give the best duty for a particular head; and there is a field for further research upon this point. The working of the pump was entrusted to a practical man, who judged that when it was running properly and well, the pressure was right. The duty of the pulsometer under this management varied from 12,036,300 to 13,391,000 foot-pounds per 100 lbs. of coal burnt under the boiler. The efficiency of the apparatus according to the formula U÷heat absorbed, was 0·012. It is noticed as peculiar that in the first test a pressure of 19 lbs. of steam produced a greater number of strokes, and pumped upwards of 50 per cent. more water than 26·1 lbs. of steam pressure—the lift being the same.

The Effect of Air on the Illuminating Power of Gas.

Dr. Schilling, in the course of a paper recently read before the German Association of Gas Engineers, quotes some experiments made by mixing air with coal gas in known quantities. The following are extracts from his tables—A representing a slit burner, and B a regenerative burner. The gas used was about 19-candle power.

	A.	Depreciation.	B.	Depreciation.
Gaslight equal .	100·0	— ..	100·0	—
„ with 2 p.c. air „ .	85·5	14·5 ..	83·3	16·7
„ 4 p.c. „ „ .	73·2	26·8 ..	74·2	25·8
„ 6 p.c. „ „ .	62·4	37·6 ..	64·7	35·3
„ 8 p.c. „ „ .	51·8	48·2 ..	52·2	47·8

The results of these experiments, reduced to unit percentages, are 7·25, 6·7, 6·27, and 6·02 in Table A; and 8·35, 6·45, 5·88, and 5·97 in Table B. In both, the ratio appears to become less as the percentage of air is increased. Allowing for experimental errors, it would seem to range from 7 per cent. per unit for 2 per cent. to 6 per cent per unit for 8 per cent. of air. This agrees closely with results previously published. It is interesting to notice that, roundly speaking, the result is the same with the flat-flame as with the regenerative burner.

The Mills Sectional Boiler.

It is notorious that the new-fashioned water-tube boilers, of which the best-known type is the Babcock and Wilcox, are not economical in working, although they are much favoured for town use, and particularly by electric lighting companies, on account of their compactness, and the ease and safety with which they may be forced on an emergency. The lack of economy of this class of boilers is to be ascribed to the fact that they do not properly utilize the radiant heat of the furnace, because there is not sufficient surface exposed to the fire. To remedy this defect, Mr. Mills, of Manchester, conceived the idea of putting the furnace inside a water casing forming part of the boiler; due provision being made for preventing chilling of the flame by premature contact with cold iron surfaces. In order to ascertain the value of this improvement, a Babcock and Wilcox water-tube boiler was purchased and worked for six months, during which time its performance was frequently tested by independent experts, until a figure satisfactorily representing its average efficiency was obtained. Afterwards the same boiler was fitted with the Mills improvement; and it has now been working thus for two years—being tested at intervals by the same experts. On comparing these results with those obtained prior to the alteration, it appeared that the proportion of unaccounted-for heat had been materially reduced. The general result of a seven days' trial of the unaltered boiler was an evaporative duty of 7·1 lbs. of water from and at 212° Fahr.; while with the Mills improvements, a nine days' trial gave a duty of 9·65 lbs. of water per pound of fuel. Mr. Crossland made the two returns 6·94 lbs. and 9·20 lbs. for an ordinary and improved water-tube boiler. The improved boiler is now being made by the Mills Sectional Boiler Company, of Pendleton; and we notice it here because it is probably the only variety of water-tube boiler that might be expected to do well with gas coke for fuel.

Mr. Thomas Hudson, who has held the office of Secretary of the West Bromwich gas undertaking since it was transferred from the Birmingham Corporation, was on Wednesday last appointed Borough Accountant and Registrar of Public Stock under the West Bromwich Corporation.

Easy Methods of Laying Service Pipes.—At the September meeting of the New England Water-Works Association, Mr. Holden, Superintendent of the Nashua (N.H.) Water-Works, stated that, owing to the sandy loam soil in that city, he was enabled to put in his service-pipes at very little expense. In the principal part of the city, it is customary to dig a trench from the main to the side walk, approximately as long as the proposed service, which is now always of galvanized iron, and then to tap the main for a cock. A piece of 1-inch hose, about 20 feet long, is then connected by a union to a cock, and at the other end by another union to a length of galvanized pipe. When everything is ready, water is turned on at the cock, and the pipe pushed into the earth for its entire length. It is then disconnected, and another length added, which is pushed in by the same means. In this manner, it is often possible to run as far as 50 feet, and save breaking up a lawn. Two men will frequently put in four services in a day; and Mr. Holden estimates that nine-tenths of the supply-pipes are thus laid. At Springfield (Mass.) the soil is also a sandy loam, and much the same manner of laying services has been employed there. The pipes used are tarred wrought iron, from 1 to 2 inches in diameter. Galvanized iron could not be used, as the pipes so made became filled with rust in two years. Mr. J. C. Hancock, Superintendent of the water-works in the city, recently stated that it was possible to push the pipe from a trench, sometimes for 75 or 80 feet, through the earth. It was often possible to do this without using water. Sometimes it has been found expedient to bore a hole with a long sand auger, and insert the pipe in this,

COMMUNICATED ARTICLE.

LIGHTING.

By W. H. Y. Webber.

PART III.—A CRITICAL EXAMINATION OF MODERN PRACTICE.

(*Continued from p.* 19.)

It will perhaps be helpful here to recapitulate the simple trigonometrical ratios which are likely to be most frequently required in problems of the kind we have to discuss in relation to the science of lighting.

In a right-angled triangle, such as that which may be supposed to be formed by any lamp-column with the ground beneath it, and with the angular ray proceeding from the lamp to any given spot upon the ground at a distance from the base of the column, there are six parts to be reckoned with—viz., the three angles and the three sides. Any three of these being given, the others can be found by calculation (with the single exception of the three angles, which may bound sides of any length); because the sides are proportional to the sines of the opposite angles.

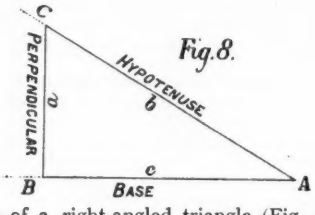


Fig. 8.

In the case of a right-angled triangle (Fig. 8), one of the angles is always known, and it is the angle of 90°. The other two angles must make 90° between them. The sides are termed respectively the base, the perpendicular—these two containing the right angle—and the hypotenuse, which subtends, or is opposite to it. The ratios, or trignometrical functions, most commonly given in engineers' hand-books, are the sines, cosines, and tangents, of all angles of from 0° to 90°. If the second angle of the triangle—that which is between the base and the hypotenuse—is called A, then the ordinary ratios are as follows: $\frac{\text{perpendicular}}{\text{hypotenuse}} = \text{sin. A}$; $\frac{\text{base}}{\text{hypotenuse}} = \text{cosin. A}$; $\frac{\text{perpendicular}}{\text{base}} = \text{tan. A}$. The tables give the functions or proportionate lengths of these parts, for the different angles of the quadrant, taking the length of the hypotenuse as unity. Thus, supposing the case of A = 20°, sin. A = 0·342; cosin. A = 0·940; tan. A = 0·364. This means that in an angle like that in fig. 8, supposing A = 20°, and b to be 1 inch long, then a = 0·342 inch, and the remaining side c = 0·940 inch, and a = 0·364 times as long as c; that is, it is 0·940 × 0·364, or 0·34216 inch.

Having, therefore, the two angles and one side given, the lengths of the other two sides are easily computed. Thus: A lamp-column throws rays at an angle of 42° at a distance of 30 feet from its base, what is the height of the light, and the length of the path of the rays? Here b = 30 feet and A = 42°. In a table it will be found that tan. 42° = 0·900, so that the height h = 30 × 0·900 = 27 feet.

The sides of triangles are proportional to the sines of the opposite angles. Thus in any triangle, representing the angles by capital letters, and the opposite sides by the corresponding small letters—

$$\frac{\text{sin. A}}{\text{sin. B}} = \frac{a}{b}; \quad \frac{\text{sin. B}}{\text{sin. C}} = \frac{b}{c}; \quad \frac{\text{sin. C}}{\text{sin. A}} = \frac{c}{a}$$

Since in the problem the angle opposite to the path of the rays is a right angle, and sin. 90° = 1, as sin. 42° is to sin. 90°, so is the perpendicular to the hypotenuse. Here sin. 42° = 0·669. Whence, as 0·669 is to 1·000, so is 27 feet to the required length, which is thus 40·36 feet.

At what angle will a light 10 feet from the ground throw its rays upon a spot 30 feet distant from its base? And how long will be the path of these rays? Here 10 ÷ 30 = 0·333, the nearest figure to which in a table of tangents is 0·344, which is the tan. of 18¼°, and therefore this is the angle sought. Sin. 18½ = 0·317; and as sin. 18·5° : sin. 90° :: 10 : x, we have $\frac{1\cdot000}{0\cdot317} \times \frac{x}{10} = 31\cdot5$ feet nearly, as the length of the path required.

These examples will be sufficient for the present purpose. We have now to consider further the proposition of Heath. If, in the case illustrated by fig. 7, it is taken as proved that $h = \frac{b}{\sqrt{2}}$ then it also follows that $b = h \times \sqrt{2}$, or $b = h \times 1\cdot414$. Whence we may express it as a rule of lighting: (1) That for the most efficient illumination of a spot in a horizontal plane by an overhead light, the height of the light will be the horizontal distance of the spot from the perpendicular passing through the light divided by 1·414; and (2) That an overhead light will efficiently command a plane area comprised within a circle having for its radius the height of the light multiplied by 1·414. Shortly expressed, *an elevated light-source will efficiently command a plane horizontal area, the radius of which is 1·42 times the height of the light above the area; or, the height of a lamp for efficiently commanding a horizontal plane area will be 0·7 of the radius of such area*—the centre of the area being the perpendicular passing through the lamp. (The Chicago rule, referred to in Vol. LVIII., p. 753, is wrong if, as may be supposed, it is based on the same theorem, since it gives results only one-half as great as the above.) These rules will be applied to the working of examples as we go on.

To avoid possible misapprehension, it may be as well to remark that the effect of Heath's theorem is to define the limit of illumination from a single source, beyond which the decrease of illumination due to the increasing obliquity of the incident rays ensues more rapidly than the decrease of effect due only to the Law of Distance. Practically, we may take it that this theorem applies to the spacing of lights over areas designed to be illuminated as uniformly as is possible with any arrangement of artificial lights; so that the more this spacing is exceeded, the spottier will be the appearance. In actual lighting, the effect of spottiness would be modified by the additional diffusion of the light from irregularly reflecting surfaces—such as walls, ceilings, &c.

The first practical consideration in connection with any scheme of artificial lighting must be the amount of illumination to be supplied; and this depends upon the purpose for which the light is needed. If we begin with the smallest requirement, which is that for street lighting, we are immediately brought up by the absence of any standard whatever. Referring to those proposed by different authorities, some of which have already been mentioned in earlier parts of these articles, it appears that Dr. W. Wallace, when uttering his sensible protest against the extravagant display that threatened to become popular in 1879, laid down the requirements of street passengers in the way of lighting as consisting only in ability to see their way, and to avoid being robbed. This is a very vague expression of opinion, intelligible enough as far as it goes, but obviously incapable of serving as a datum in order to determine the minimum spacing of street lamps.

Mr. Ralph Richards and others hold that the pleasure of distinct vision should be the criterion of good street lighting; and his minimum for roadway lighting is the equivalent to the light of a standard candle at a distance of 10 feet. Mr. W. Sugg's idea of good outdoor illumination in 1879 was the equivalent of the light of a standard candle at a distance of 2 feet, which would be sufficient to enable a man with good eyes to read a leading article in *The Times*. This, however, is an extravagant standard; for in what Mr. Sugg spoke of at the same time as well-lighted neighbourhoods—meaning places where the street lamps are provided with 5-feet burners—it only obtains from a radius of 7ft. 6in. from the lamp-post, and it does not appear that anybody ever proposed to fix such lamps so closely together as 15 feet. When Mr. Deacon was led in 1878 to discuss the question of street lighting for Liverpool, he mentioned street gas-lamps spaced 27ft. 6in. apart, only to dismiss the idea as irrational. Mr. Corbet Woodall put 48 lamps in 1500 yards of street between Waterloo Bridge and the South-Western Railway Terminus, which was a little more than 60 feet from lamp to lamp on each side of the road; and the result was that "a newspaper could be read without difficulty in any part of the road." This was luxurious lighting; and the same may be said of the central Birmingham experiment, described in the JOURNAL, Vol. XLIV., p. 21. Professor Robinson takes as the standard of ordinary street lighting the intensity of the light falling upon a unit area of pavement 50 feet from an ordinary street lamp, which he computes, by an approximate rule, to be equivalent to 0·000864 candle. A 12-candle burner will give, at 50 feet distance, the same light as one candle at 14 ft. 5 in., for—

$$12 : 1 :: 50^2 : x^2; \text{ whence } x = 14 \text{ ft. } 5 \text{ in.}$$

This, therefore, is greatly below Mr. Richards's estimate of what is desirable.

It is well to point out that the use which Professor Robinson makes of his determination of what he calls the minimum for a street-lighting effect is to determine the spacing at which electric arc lamps can be calculated to produce the same result. This is absurd, because it ignores the fundamental difference between the intensities of the compared sources. It is obvious that before any such minimum can be adopted as a datum for the satisfactory spacing of lights, we must know the power of these lights. If the only condition to be fulfilled in lighting a straight roadway of stated length was that the intensity of the light should in no part fall below a certain minimum, we might satisfy the requirement by suspending a single electric arc lamp on a line in the middle of the length; thus making each end exhibit the minimum illumination proposed. Such a solution of a lighting problem would be practically inadmissible, yet it would exactly fulfil Professor Robinson's one condition.

As Mr. Richards shows, the physiological aspect of street lighting must be taken into account in treating all problems of this kind; so that before we can say what is really the minimum lighting effect allowable anywhere, we must know how much the wayfarer's eye is likely to be strained in the most brilliant parts of the thoroughfare. It is this consideration that renders it practically impossible to exactly balance, upon the sole basis of the minimum lighting effect, one style of lighting with another involving the use of lights of much higher power. To avoid offence to the eye, we must *raise the minima as the maxima are intensified.*

(*To be continued.*)

TECHNICAL RECORD.

THE DESSAU CENTRAL ELECTRIC LIGHTING STATION OF THE GERMAN CONTINENTAL GAS COMPANY.

(*Concluded from p. 23.*)

RESULTS OF THE FIVE YEARS' WORKING OF THE STATION.

Working with the gas-engines has proved advantageous in all ways; and under the condition that the gas need not be purchased, but that both the gas and electrical works are in the same hands, the plan is in many cases worthy of consideration for medium-sized and small towns. The advantages offered by such central stations are as follows:—

1. Small space required, and therefore a small area of land.
2. Small water supply (23 to 24 litres per horse power, and with improved new cooling arrangements even considerably less).
3. Independence of railway communication, and avoidance of coal transport through the town.
4. No nuisance from smoke.
5. No danger of explosion.
6. Lower cost for installation as compared with steam-engine plant of similar size: (*a*) because the area of land required is considerably less; (*b*) because the distributing cables are considerably cheaper, inasmuch as a piece of land in the centre of the town, in the immediate vicinity of the place where electricity is required, can be more readily found and utilized for working with gas-engines than for working with steam-engines; (*c*) because the cost of a gas-engine plant of more than 100-horse power is very much cheaper than a steam-engine plant of the same size, including reserve boiler, boiler-house, chimney, &c.
7. Less loss of pressure in the distributing system, on account of the more favourable situation of the central station.
8. Small number of hands required.
9. Ready and exact control of the consumption of fuel (gas) by means of gas-meters at all times for every engine.
10. More certain and convenient working, especially for moderate-sized works, where the variations in a small total supply generally occur more suddenly, and where the period of working is frequently only a very short one. When an unexpectedly large supply is demanded, gas-engines are much sooner set working than boilers.

With reference to the cost of working, more especially as regards the cost of the gas itself, as a matter of course it must be understood that, in order to make a correct comparison of any value with the cost of steam-engine works, the cost of the gas itself must be calculated on its own basis; and that required for the electrical central station must not be burdened with factors which apply solely to the supply, distributing, and disposal of illuminating gas in towns. For if a gas-works supplies a large quantity (say, 500,000 cubic metres) of gas to an individual large consumer—the central station, presumably—the general cost of management is not raised in the slightest thereby, and all that has to be taken into consideration is the expense for producing the gas, and for the repairs, renewals, &c.—the special cost of manufacture in its narrower sense. The proportion of the management expenses and salaries of officials may therefore be neglected; and the expenses incurred in some gas-works by the public lighting and loss from the mains need not be considered, inasmuch as the augmentation of the private consumption and increasing the public lighting with the same quantity of gas as that required for the central station, necessitates the lengthening of mains and the fixing of numerous gas-meters, as well as other sources of loss. All question of participating in the total loss is avoided when the central station is situated on the gas-works, or is connected with them by a special main, which is then subjected to none of the usual variations. The division of the gas-works capital expended in street mains has to be treated in a similar way; and only that portion of the distributing plant specially laid down for the electrical department can be considered. Moreover, if the value of the gasholder has to be reckoned, inasmuch as the accumulators would be charged in the daytime, or during a working of 20 hours in the period of greatest consumption, the drawing of gas from the works does not cause any increase in the cost of storeage plant. Therefore the 'actual' cost of gas for a central electric station is practically restricted to the cost of raw material and fuel, less the value of the residuals, and with a small additional expenditure for manufacturing, including repairs and renovations.

Next to the comparison between the cost of working with gas or steam engines, an important consideration is the cost of establishing a central station. The three chief points which enable the erection of a gas-engine central station to be carried out with a small amount of working capital have been given in paragraph 6, under the advantages of such a system as that detailed above. It is only necessary to specially mention here that comparisons recently made with the cost of working stations with gas-engines, as compared with steam-engines, have turned out very much in favour of the former; inasmuch as the expense of the largest gas-engine plants hitherto made was only about as much as that of steam-engine plants of similar size, while at the present time the 120-horse power gas-engines, including erection, cost only about half as much as a steam-engine plant with reserve boilers, steam-boilers, buildings, and chimney. A double-cylinder 120-horse power gas-engine does not cost more at the present time than a 60-horse power engine did in 1886.

It may be assumed with the greatest certainty that in the course of a few years even larger gas-engines, giving increased economy, will be built, since their size has been more than doubled in the last five years. Consequently, we may reckon on not only making subsequent enlargements of central stations with more powerful gas-engines, but also on working with a considerably smaller consumption of gas. If, therefore, an electrical station is required for a town or a company with an initial capacity of 7500 simultaneously burning lights, or about 10,000 installed lamps, a comparison should be instituted between steam and gas engine installations; but not only should the cost of running the engines be considered, but certainly also the other important advantages of gas-engine installations.

A plan for such an installation for 10,000 lamps is given in fig. 3. It is furnished with four gas-engines of 120-horse power and two accumulator batteries for each, which are placed in two upper stories in the same building. Charging the accumulators with two engines would have to commence in the winter months probably at 8 a.m., and would be completed at 10 p.m., by one shift of men having 2½ hours off at midday; since, in the absence of stoking of boilers, work is lightened to an extra-

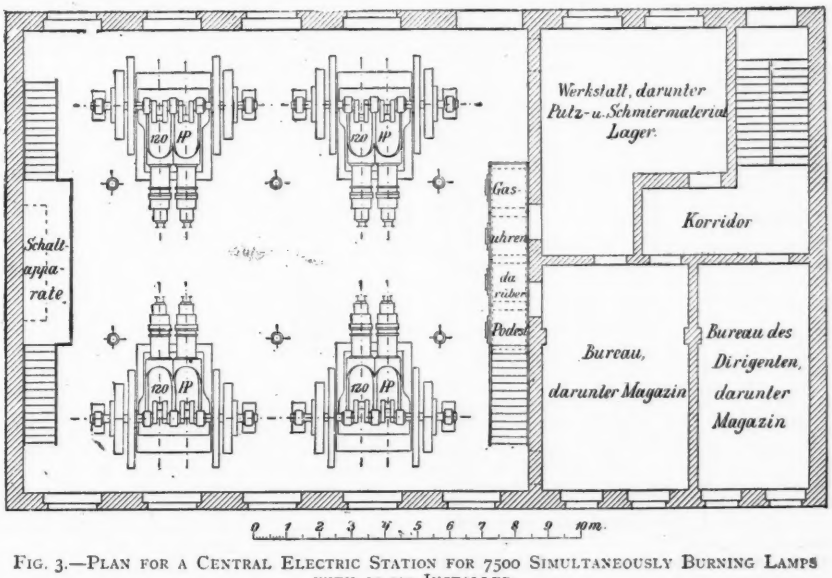


FIG. 3.—PLAN FOR A CENTRAL ELECTRIC STATION FOR 7500 SIMULTANEOUSLY BURNING LAMPS WITH 10,000 INSTALLED.

Schalt apparate—Switches. Gasuhren darüber Podest—Gas-meter with Supervisor's platform above. Werkstatt darunter Putz und Schmiermaterial Lager—Workshop with Store below for Oil and Lubricants. Bureau des Dirigenten darunter Magazin—Manager's Office with Stores below.

ordinary extent. During the periods of greatest consumption, the third engine would work directly on the distributing system, while the fourth engine could remain entirely in reserve. The accumulators alone would supply the demand at other times. The space required for the whole business of working 10,000 installed lamps, including offices, workshops, and stores, according to this plan, is only 370 square metres. By locating the offices, &c., elsewhere and providing a third storey for accommodating the accumulators, a still smaller area of land would suffice. From information we have received, it seems that 150-horse power double-cylinder gas-engines will be ready probably next year; then four engines and two accumulators will be able to supply 10,500 burning lights, or about 14,000 installed lamps.

As a matter of course, we do not go so far—and we emphasize this—as to recommend gas-engine power for central electric stations on the above plan under all circumstances. But it, appears to us that the experiences and results above described, of a statistical and accurately conducted practice of nearly five years, can at least lead (1) to setting aside the impression that gas-engines are useless for central electric stations, after thousands of such engines have proved so excellent for working electrical plant; (2) to making rational comparisons with steam-engine installations—that is, taking into consideration the various points herein indicated; and (3) to keeping in view the development of gas-engine construction up to the present. These motors have, as already shown, doubled in size within five years; and therefore subsequent developments will in all probability result in even larger gas-engines, exhibiting considerably greater economy as regards gas consumption.

The well-known prognostication of the late Sir William Siemens, "It is only a question of time when solid fuel must be replaced by the gaseous—viz., coal gas—in order to arrest the present enormous dissipation of fuel," and also ultimately to commence the abolition of the smoke nuisance, may well be kept in view when considering the question of central electric stations. According to the most recent researches on the theory of heat, the utilization of fuel is as follows:—

	In Steam-Engines.	In Coal Gas-Engines.
Sealy (*Journ. für Gasbel.*, 1883, pp. 552, 567)	8·0 per cent.	16·5 per cent
Clerk ("The Gas-Engine," 1886, pp. 263, 267)	11·1 ,,	21·0 ,,

Perhaps the conversion of many municipal corporations and societies to the idea of central electric stations will become easier when they have proved working with gas-engines to be more advantageous than working with steam-engines, by an exact test carried out under their own supervision. This will be the case with others, when new gas-works are near or have to be built which could supply the central station with gas without any considerable extra expenditure of capital.

In all cases, the working of gas and electrical plant under the same management is to be recommended, whether gas or steam engines are adopted, in order that, on the one hand, the commercial and technical operations may be conducted more in unison and more cheaply, and, on the other, that the public requiring heat, light, and power will be in a position to use both gas and electricity in the most satisfactory manner without any mutual competitive struggles.

Death of Sir G. B. Airy.—Early on the second day of the present year, and six months after the celebration of the 90th anniversary of his birthday, Sir George Biddell Airy, the seventh Astronomer-Royal, passed to his rest at his residence in Greenwich. He had a fall in the summer, and received an injury which involved a surgical operation. This seemed successful at the time; but he gradually succumbed to resultant weakness. Some years ago his services were utilized in connection with the settlement of the conditions under which sales of gas should take place; and he was Chairman of the Commission appointed to consider the general question of standards, also of that entrusted with the superintendence of the new standards of length and weight, after the destruction of the Houses of Parliament by fire in 1834. Sir George was President of the Royal Society from 1871 to 1873; he was made a C.B. in 1871, and a K.C.B. in 1872. He was medallist of the French Institute, of the Royal Society, of the Royal Astronomical Society, and of the Institution of Civil Engineers. He retired on a pension in 1881.

The Work of the Patent Office in the Past Year.—During the year 1891, the number of applications for patents was 22,872, or 1565 more than in the preceding twelve months. The work of the office in 1890 resulted in a surplus which exceeded £100,000; and as the various operations were carried on in a practically identical manner, it is presumed (the absolute figures not being yet available) that there will be an even greater surplus arising from last year's business. Questions have from time to time arisen as to how the surplus revenues should be employed. One suggestion is that the fees should be reduced; while another is that certainly a portion of the excess should be applied to the completion of the work of abridging and indexing specifications accepted prior to 1884—a work which has been for some time in arrear, the persons engaged thereon having been temporarily suspended. A noteworthy incident in connection with the affairs of the Patent Office in the past year is the conferring upon the Comptroller-General—Mr. (now Sir) Henry Reader Lack—the dignity of knighthood by the Queen, in recognition of his public services.

THE STRUCTURE AND CHEMISTRY OF FLAMES.

At a recent Meeting of the Chemical Society, a communication on the above subject was presented by Messrs. A. Smithells and H. Ingle, of the Yorkshire College, Leeds. The following extracts therefrom are taken from the report of the Society's proceedings in the *Chemical News*.

The authors have been engaged for a twelvemonth in investigating the chemistry of flames produced by burning known hydrocarbons; and the publication of their results in the present form is consequent upon the appearance of a paper by Herr N. Teclu in the *Journ. Prakt. Chemie* (Vol. XLIV., p. 246), who describes the phenomenon which served as a starting-point in the author's inquiry. If a long glass tube be fitted, by means of a cork, over the metal tube of a Bunsen burner, so as to form a wider continuation of it, the flame can be caused to burn at the top of the glass tube. When the gas is turned off slowly, the flame becomes smaller, and develops a sharply-defined inner cone of a greenish colour, which ultimately becomes almost a flat disc of flame, and enters the glass tube. As a rule, it will descend at a rapid rate for some distance, then begin to oscillate, and finally either detonate and light the gas at the bottom of the metal tube, or else go out. If the gas supply be very carefully regulated, the flame may be brought into such a state that it will descend the tube for a short distance, and then re-ascend; and in this condition it is very easy to see that, while the lower cone is moving, there remains at the top of the tube a steady cone of flame of a pale lilac colour. By heating the glass tube at one point, so as to increase there the rate of inflammation, it is possible to fix the oscillating inner cone—that is, to prevent its re-ascent. It is also possible to effect this by narrowing the bore of the glass tube at one point, so as to diminish the rate of inflammation—*i.e.*, to prevent the descent of the inner cone past that point. In this way it is practicable to separate the two hollow cones of combustion which constitute the Bunsen flame, and to keep them any distance apart for any length of time. This permits of the aspiration of the gases from the space between the cones without any chance of admixture of outside air, or of products of combustion from the upper cone.

The apparatus used by the authors in most of their experiments consisted of two glass tubes, one of which slides very easily within the other. The inner tube, which is the longer one, is united to the outer one by an india-rubber collar, through which it slides freely; and the two tubes are kept coaxial by a ring of asbestos packing. The projecting end of the inner tube may be fitted to a Bunsen burner; but the authors have usually led separate supplies of gas and air into the apparatus by a T-tube, instead of using a Bunsen burner, in order to have a better control of the flame. With this apparatus a non-luminous flame is easily obtained; and the two cones can be separated in two ways. If the apparatus is arranged so that the flame is formed at the orifice of the wider tube, and the orifice of the narrower one is 8 or 10 centimetres below it, on increasing the air supply the inner cone of flame will ultimately descend and rest upon the orifice of the inner tube. If, on the other hand, the inner tube be made to project beyond the outer one, and the non-luminous flame be formed on it, then, if there be a sufficient air supply, on sliding up the outer tube, it will, as it passes the flame, cleanly detach and carry up the outer cone; leaving the inner one still burning on the inner tube.

The authors have made similar experiments with flames of liquid hydrocarbons by charging air with the vapour of the liquid by passing it through a "saturator," such as is used for producing the ether-oxygen lime-light. The vapour-charged air is afterwards mixed with more air; and, by suitably regulating the proportions, a non-luminous flame is obtained, and divided into two cones. In the case of liquid hydrocarbons, the lower cone of flame usually appears to be divided by dark spaces into several petal-like divisions, which are in rapid rotation. In the case of benzene vapour, the following sequence of appearances is presented: Starting with the orifice of the inner tube 8 or 10 centimetres below that of the outer one, a luminous smoky flame is first obtained at the latter. As air is gradually added, the flame becomes less and less luminous, and an inner cone begins to develop; but before this has become non-luminous, it descends to the inner tube. More air makes both it and the other cone non-luminous; and this state may be maintained. If now somewhat less air is supplied, a luminous streak appears at the tip of the inner cone, and passes right up and through the tip of the upper cone. If more air is supplied, the upper cone of the flame begins to disappear, and only the upper part of it remains. This also gradually fades away, and then there is only the lower cone left. Still more air produces a visible effect on the inner cone; the colour changing, and the combustion becoming less intense, until the cone rises from its seat, passes upwards, and disappears. There is thus a gradual transition from the richly-luminous flame to one consisting of a simple pale blue cone just on the point of extinction through excess of air.

The hydrocarbons examined by the authors were ethylene, methane, pentane, heptane, and benzene. Coal gas was also used. The gases from the regions between the two cones of flame were analyzed in all cases volumetrically or gravimetrically. The results obtained (which were tabulated by the authors) show that the products of combustion of the first cone

are essentially CO_2, H_2O, CO, and H_2; and that the second cone is due to the combustion of the CO and H_2 with the external air. The results are in harmony with the conclusions of Blochmann, obtained indirectly, and with the not generally known work of Dalton on the explosion of methane and ethylene with oxygen in quantities insufficient for complete combustion, which was repeated in 1861 by Kersten.

The authors point out: (1) That carbon, according to Baker's experiments, even in excess of oxygen, burns preferentially to CO, and not to CO_2; (2) that the heat of combustion of gaseous carbon to CO is probably greater than that of hydrogen to H_2O; (3) that, according to Dalton, CH_4, when burnt with its own volume of oxygen, gives products represented in the equation—

$$CH_4 + O_2 = CO + H_2O + H_2;$$

and they conclude that this equation represents the character of the change first taking place in the inner cone. But as the two substances CO and H_2O act upon one another, the case is one of reversible change; and four products will result—viz., CO_2, H_2O, CO, and H_2.

The conditions of equilibrium of this system, according to Dixon, are expressed by the coefficient—

$$(CO \times H_2O) \div (CO_2 \times H_2)\ 4.$$

This is subject to certain conditions of temperature and dilution. The authors in their most reliable experiments—viz., the gravimetric ones—with ethylene and coal gas, get numbers not greatly differing from 4; but they are still engaged in studying this question.

The authors have succeeded in dividing into two cones flames produced by the admixture of air with cyanogen, sulphuretted hydrogen, carbon bisulphide, and decomposed ammonia—*i.e.*, N_2+3H_2. The products of the inner cone in the case of cyanogen were found in one experiment to consist of carbon monoxide and carbon dioxide, in the proportion of two volumes of the former to one volume of the latter.

Professor Smithells is continuing the experiments with a view of elucidating the following points: (1) The influence of differences of diameter of the tubes and rates of efflux on the fractional combustion. (2) The exact composition of the interconal gases in the case of hydrocarbons, and also of mixtures of CO + H_2, so as to ascertain it, and in what way the above coefficient varies with the composition of the gases and other conditions. (3) The composition of the interconal gases from hydrocarbon flames while carbon is being liberated, so as to ascertain whether the luminosity of flame is due to simple decomposition of hydrocarbons by heat, to preferential combustion of hydrogen, to partial decomposition, or to other change. (4) The exact nature of the flame of cyanogen, so as to ascertain what governs the proportions of carbon monoxide and carbon dioxide formed in the inner cone. (5) The manner in which the partition of oxygen takes place in the inner cone between hydrogen and sulphur, and carbon and sulphur, and so as to obtain information as to the affinities of carbon, hydrogen, and sulphur for oxygen. (6) The spectroscopic appearances of the flames.

At a subsequent period of the meeting, Professor SMITHELLS submitted a note on the same subject, of which the following is an abstract:—

The author began by giving a brief summary of the various views that have been held on the subject. With one or two exceptions, there has been general agreement, since the time of Berzelius, that an ordinary candle-flame, or the flame of coal gas escaping from a circular hole, is divisible into four chief regions: (1) The dark inner part; (2) the luminous part; (3) a small bright blue part at the base of the flame, thinning off rapidly as it extends upwards; and (4) a dim, scarcely visible, faintly luminous mantle surrounding the whole flame.

The explanation which the author would give of these regions is as follows: The gas or vaporized wax, on issuing from the orifice or wick, becomes mixed with air and burns. Whether or not the flame is luminous, depends on the rate at which the combustible is supplied. If slowly, sufficient air is admixed with the gas for non-luminous combustion. Thus a very small gas-flame is non-luminous; and so also is the flame of a candle with the wick cropped close to the wax. It is conventionally said that coal gas burns with a luminous flame. It is just as true to say that it burns with a non-luminous flame. The small non-luminous flame of coal gas, or of a short-wick candle, is seen to have the same structure as a Bunsen burner—viz., a bright blue inner cone, and a pale lilac cone superposed upon it. The author supposes that we have here the same chemical changes occurring as are dealt with in the previous paper—viz., that the first combustion in the inner cone is mainly to CO_2, H_2O, CO, and H_2; and the final one in the outer cone is mainly that of CO and H_2 to CO_2 and H_2O. This is made more probable by the fact that, if the gas supply be increased, the luminous tip shows just at the point where it appears in the experiment with benzene; and that, even after it is considerably developed, the shape of the flame betrays the persistence of the inner cone. As the gas supply is further increased, the luminous area becomes increasingly great; the relics of the two original cones being very small.

The author's view is further enforced by the simple experiment of taking a flame about 5 centimetres high from a Bunsen burner with the air-holes stopped; noting the blue region at the base of the flame, and the dim mantle outside it, and then slowly turning on the air. The gradual transition shows unmistakeably that the blue part and the mantle are the "rudiments" of the two cones of a Bunsen flame.

With regard to the luminous part, everything goes to show that it is mainly a region where hydrocarbons are decomposed by the heat of the outer parts of the flame; and the precise nature of the change is being studied by the author. The dark inner cone contains mainly unburned gas, mixed with some products of combustion from surrounding regions.

A commonly-held view, that the mantle of a luminous flame is due to heated air and products of combustion, is inconsistent with the above explanation, and also with the fact that, in recent experiments, it has been found impossible to render air luminous at the highest attainable temperatures.

The view that carbon is separated in a flame owing to the preferential combination of oxygen with hydrogen, is opposed, the author thinks, to all experimental evidence, which he is of opinion goes to show that, if the oxygen supply be limited, carbon will burn before hydrogen.

The author would describe a luminous flame as follows: (1) An outer sheath or mantle, with (2) an inner bright blue portion visible at the base of the flame. These two parts correspond respectively to the outer and inner flame cones of a Bunsen flame, and mark the region where the coal gas or candle gas is burning with a large quantity of air. (3) The yellow luminous part, marking the region where the heat of the parts (1) and (2) is decomposing hydrocarbons, setting free carbon, which rapidly glows and burns. (4) The dark inner region, consisting of unburned gas, mixed with products of combustion of the surrounding parts.

Novelty is not claimed for the foregoing description; but the author considers that the experiments described in the preceding paper put the matter in a somewhat new light.

Sudden Death of Mr. Leslie Cloudsley.—A large section of our readers, especially those in the southern districts of England, will learn with deep regret of the sudden death of Mr. Leslie Cloudsley, brother of the Mr. John L. Cloudsley who has for some years been a member of the firm of Messrs. W. and B. Cowan, and has had charge of the London branch of the business since its establishment. The sad event occurred, with scarcely a moment's warning, on Monday evening last week. For a few days previously, Mr. Cloudsley had complained of a slight cold; but he did not attach any importance to it, as it did not interfere in any way with his business or social engagements. At about half-past eight on the evening named, while joining in conversation with friends, he was observed to take an unusually deep breath, and immediately afterwards life was found to be extinct—death resulting from a sudden failure of the heart's action. Mr. Cloudsley was only in his 42nd year, and was unmarried. He had for many years resided at Willesden with his brother, with whom, as our readers know, he was associated in business. Those who were in the habit of meeting the late Mr. Cloudsley would never have suspected that one who always displayed so much energy and activity could have a constitutional defect of so serious a nature as that which brought his useful life to so melancholy a close. His characteristic activity was frequently displayed in the cricket-field and in the moderate indulgence of athletics. He was Vice-President of the Willesden Cricket Club. In the social circle in which he moved, his loss will be very greatly felt, for he was a man of many strongly-attached friends. Not less will it be felt by his associates in business, who will, we are sure, extend to his relatives the sympathy of which, in their sudden bereavement, they stand so much in need. The funeral took place last Friday

The Rose Fuel-Gas Process.—According to the *American Manufacturer*, a gas-making process, called after its designer (Mr. Rose), is being exploited by the National Heat and Power Company. This process is practically a combination of a gas-producer with a water and oil gas manufacturing apparatus. The so-called Rose gas has been analyzed by Dr. E. G. Love, of New York, who finds it to be composed of about 40 per cent. of hydrogen, 15 to 20 per cent. of marsh gas, 10 to 15 per cent. of carbonic oxide, and some 20 per cent. of nitrogen, with about 10 per cent. of "heavy hydrocarbons." It is claimed that, while this is a gas of high heating power, it also has good illuminating properties. The performances of the Rose gas, when used as an illuminant, are also vaunted by the same well-informed organ, which gives a list of ostensible tests of this gas with several well-known types of incandescent gas-burners, the net result of which is *nil* in the estimation of an expert; not one of the published determinations containing the data necessary in an accurate statement of this kind. Seeing the large amount of nitrogen contained in the gas, and the equally high proportion of heavy hydrocarbons, it can only be concluded that the effect of the former is to kill the latter, and that the Rose gas would be all the better without the contribution of the "producer" section of the apparatus. In this case, the remaining plant would be simply a carburetted water-gas apparatus—probably no better, if not worse, than other forms of this kind of plant. It seems only too likely that Mr. Rose has failed, as others have done before him, in the attempt to make, by the cupola method, a fuel gas that shall be both good and bulky. The protest of the experienced Yankee gas consumer—that "he did not want any nitrogen in his gas"—yet covers the field occupied by inventors of the Rose order.

ANTISEPTICS AND MEDICAMENTS DERIVED FROM COAL TAR.

In the current number of the *Moniteur Scientifique-Quesneville*, the principal original contribution is an article by M. Trillat upon the medicinal and sanitary value of coal-tar derivatives. The writer remarks, in introducing his subject, that among the innumerable derivatives of coal tar, most of which have been worked out with a view to the colour industry, there are many which can be utilized in general therapeutics and antisepsis, among which he enumerates phenol, resorcine, salicylic acid, acetaniline, &c. It is curious how the study of antiseptics and medicaments derived from coal tar has been allied with that of the colouring matters obtainable from the same source; but the fact remains, and the industry of the one class of derivatives is similar to that of the other. As with the colouring matters, the chemistry of the antiseptics and drugs has its history. It only developed slowly—being attended with its promises and failures; and if the list of this class of commodities is not so long as that of the dyes, they nevertheless form the basis of important and very lucrative industries, principally in Germany. The reason for this latter fact M. Trillat finds in "the prodigious activity of the German workers, not only in the Universities, but also, and above all, in the numerous laboratories and dye factories." In this way, chemistry has been enriched with a crowd of new bodies; thus verifying at the same time the influence of theory upon practice, and the reciprocal influence, so that all that the one has gained has contributed to the development of the second. The isolation of phenol dates, according to M. Trillat, from the distillation of tar; and therapeutics soon made use of it. So that as from 1856 phenic acid replaced in *Materia Medica* the preparations of coal tar which were only useful on account of their containing a small proportion of phenol. Of course, as a French author, M. Trillat ascribes the development of antiseptics to the influence of M. Pasteur, altogether ignoring Lister; and he goes on to say that new outlets for antiseptic methods were found in tanning, in the paper industry, in the preservation of wood, as well as in that of diverse organic substances. So that apparently M. Pasteur had something to do with the practice of creosoting, which was an important industry before he was ever heard of. In the search after antiseptic or medicinal applications, two great obstacles were met with—toxicity and insolubility. The latter inconvenience has been remedied by forming soluble salts; but unfortunately the latter device has sometimes proved detrimental to the antiseptic qualities of the product. M. Trillat then proceeds to discuss salicylic acid and its derivatives the salols. He shows how, in the amido series, therapeutics utilizes antifebrine, exalgine, and phenacetine. But it is to the pyridic series that the attention of chemists has been above all attracted. Pyridine was first obtained by Anderson in 1846 from the dry distillation of bones. Runge detected the presence in coal tar of quinoline, the relation of which with Anderson's pyridic bases was soon established. M. Trillat points out how these relations favoured the hope that the important alkaloids of the cinchona group might be derived in their turn from the pyridic series of coal tar. Antipyrine was obtained by Knorr, and has proved a most valuable product, in the commercial sense. The fatty series of coal-tar derivatives have also produced valuable medicaments, among which may be cited chloral, sulphonal, &c. Finally, attempts have been made to use coal tar directly as an antiseptic. By combining tar with a fatty oil in presence of an alkali, we get lysol. Treating it under certain conditions with sulphuric acid yields creoline. The treatment of the paraffin of tar with sulphur gave a product which was sold under the name of thiole; the same method being also applied to certain mineral and animal oils. The remainder of the article gives detailed explanations as to the preparation and nature of the compounds named, and forms a useful report upon the general subject.

THE DISTILLATION OF COAL TAR.

At the last Meeting of the Bavarian Association of Gas and Water Works Managers, Dr. Windmann, of Munich, presented a paper, in which he described the distillation of coal tar as conducted at the Pasing Works in Bavaria. The full text of the communication was given in the report of the proceedings contained in the *Journal für Gasbeleuchtung;* and the following particulars are taken from an abstract translation in the *Journal of the Society of Chemical Industry*.

The distillation of the tar is effected in large wrought-iron stills, heated by means of a furnace placed beneath the still. At the commencement, a gentle heat is applied; and the distillation is performed at the ordinary pressure—the water in the condensing apparatus being kept cold. The distillate consists of light oil and water. After all the water has come over, the heat is gradually increased, the atmospheric pressure diminished, and the temperature of the water in the condenser raised; the products of distillation being medium oil, heavy oil, and anthracene oil. The distillation at the stage at which the latter comes over is aided by the injection of steam and the application of an exhaust air-pump. The residue of distillation is pitch, which is run out from the bottom of the still.

The products are worked up in the following manner: The light oils having a specific gravity below 1, and consisting of benzene and its homologues (phenol, pyridine, and naphthalene), are subjected to fractional distillation. The crude benzene thus obtained is, in the first place, washed with a weak solution of caustic soda, in order to remove all phenols; then treated with dilute sulphuric acid, which extracts the pyridine bases; and finally washed with concentrated sulphuric acid, which separates all tarry substances. The product is then subjected to distillation by means of steam; the following fractions being obtained:—

Benzene I.—Boiling from 80° to 100°; used in the preparation of aniline.

Benzene III.—Boiling from 100° to 120°;
Benzene IV.—Boiling from 110° to 140°; } used in the preparation of toluene, xylene, &c.

Benzene VI.—Boiling from 140° to 175°;
Benzene VIb.—Boiling from 175° to 195°; } used in the manufacture of india-rubber.

The residue is added to and worked up with the medium oils. The soda solution, partially charged with phenols, is completely saturated therewith by mixing it with oil rich in phenols, separating the solution from the undissolved oily portion, and decomposing by means of an acid. Crude carbolic acid is thus obtained; and this is subsequently worked up into the pure crystallized acid. The acid solution, charged with pyridine, is neutralized with ammonia; and the crude pyridine thus liberated is subjected to fractional distillation. The product is now largely used for the denaturation of alcohol. The tarry acid liquor, after being washed with water and neutralized, yields on distillation a further portion of crude benzene; the residue being employed for fuel purposes. The medium oil, having a specific gravity of about 1, is subjected to fractional distillation. The first distillate represents crude naphtha, and is worked up with the light oil. The second distillate contains naphthalene and phenol. The former crystallizes out on cooling, and is separated by draining the oil and subjecting the residue to hydraulic pressure. The drained oil is then submitted to fractional distillation; the first portions, which are highly charged with phenol, being used for the preparation of carbolic acid, while the higher-boiling fractions are employed as creosote oils. The heavy oils, having a specific gravity of about 1, contain phenol, naphthalene, and neutral oils. On re-distillation, an oil highly charged with naphthalene is obtained, the lower boiling fractions of which contain large quantities of phenol. This oil is worked up like the second oil obtained by the re-distillation of the medium oil. On cooling, the last product of the distillation of coal tar—anthracene—mixed with other high-boiling hydrocarbons, crystallizes out. This is collected in filter-presses, and the mass subjected to hydraulic pressure. The filtered oil is re-distilled—the first fractions being added to the creosote oils; while from the higher-boiling portions a further quantity of crude anthracene is obtained, which, is, however, inferior in quality and percentage strength to the anthracene separated from the original oil. The water which comes over with the light oil in the early part of the process of distillation, being saturated with ammonia, is converted into ammonium sulphate along with the gas liquor which has been separated from the tar before it is submitted to distillation.

Death of Mr. T. J. Evans, of Merthyr Tydfil.—The Chairman of the Merthyr Tydfil Gas Company, Mr. Thomas John Evans, J.P. for the counties of Glamorgan and Brecon, died suddenly on Saturday, the 2nd inst., at his residence, Glyncelyn, near Brecon, aged 60 years. Mr. Evans had been a Director of the Company since 1860, and Chairman from 1880.

Death of Mr. T. Moore.—The ranks of the gas managers of the Manchester district have sustained a loss by the death, on Tuesday last, in his 57th year, of Mr. Thomas Moore, who for nearly 15 years occupied the post of Gas Engineer of the Macclesfield Corporation. Mr. Moore was born at Stretford, near Manchester; his father being a plumber and gas-fitter in the town. He was educated at the Manchester Grammar School; and, on leaving that establishment, assisted for a short time in the management of his father's business. Subsequently he was articled to the Engineer of the Liverpool Gas Company, where he qualified himself for entering the gas engineering profession. From Liverpool he went to Stafford, to take the position of Deputy-Manager of the gas-works; leaving that town in 1877 to assume more responsible duties at Macclesfield. His first work on arriving there was to prepare plans for a thorough reorganization of the works; and this was effectually carried out during the period of his supervision of them. Mr. Moore's health began to show signs of failing several years ago; but this did not interfere with the proper discharge of his duties till within the last 18 months. An extended leave of absence having failed to produce any appreciable benefit, he sent in his resignation, and was succeeded by Mr. H. H. Ford, who had charge of the works during his chief's illness. Mr. Moore was a member of the Manchester District Institution of Gas Engineers, and occupied the presidency in 1887. He was also a prominent Mason—joining the craft when at Stafford, where he was P.M.; and he held similar rank in the Combermere Lodge, No. 295, at Macclesfield.

REGISTER OF PATENTS.

Governing the Speed of Gas-Engines.—Carling, J., of Middlesbrough. No. 110; Jan. 3, 1891. [6d.]

To regulate the speed of gas-engines as ordinarily constructed, says the patentee, the valve which admits the gas to the cylinder has a spindle projecting downwards; and immediately below the end of this spindle is an oscillating finger mounted on a lever actuated every alternate stroke of the piston by a cam in such a way that, when the engine is running slow, the finger catches the end of the valve-spindle and opens the valve. The finger, however, is capable of oscillating on a fixed centre; and its oscillation is then caused by the rise and fall of the governor balls. Thus, when the engine is running too fast, the action of the governor pushes the point of the finger on one side, so as to cause it to miss the end of the projecting spindle; and consequently, during one or more strokes, the gas-valve is closed until the speed has slackened off. By this method, therefore, the supply of gas is an intermittent one. According to the present invention, however, the supply of gas is not intermittent, but continuous—that is, the cylinder receives a portion of gas at every alternate stroke; but in larger or smaller quantities, regulated by the speed of the engine.

To accomplish this, instead of an oscillating finger, an oscillating quadrant is employed, the outer edge of which is eccentric to the centre of oscillation. Thus, when the engine is running slow, and the governor balls are down, the highest point of the quadrant comes immediately under the valve-spindle, and by the action of the cam on the lever, the valve obtains the highest lift. But when the speed increases, a lower part of the quadrant comes in contact with the spindle, and the lift of the valve is diminished. Thus, the cylinder receives more or less gas at every alternate stroke, but in regulated quantities according to the speed of the engine.

Slow-Speed Condensers.—Clapham, T., of Keighley. No. 1563; Jan. 28, 1891. [6d.]

This invention relates to that class of condenser which consists of a vessel of cylindrical shape in cross section, having partition-plates placed near each of its outer ends so as to form an upper, a lower, and an intermediate cavity therein; the upper cavity being opened or joined to the lower cavity by a series of intervening pipes or tubes extending through the intermediate cavity, so that water may freely pass from the lower to the upper cavity without actually entering the intermediate one. The invention consists of so constructing these pipes or tubes and the upper partition-plate that any of the pipes or tubes may be detached for repairs, or for the substitution of new ones, without interfering with any other.

This object is attained by forming a flange or collar near one end of each pipe, so that when the outer end of a pipe is inserted into one or other of the openings made in the lower partition-plate, this flange will fit over it, so as to cover any interstices that may exist between the pipe and the plate. In the upper plate a downwardly projecting flange is formed to surround each opening; and on the lower interior edge of this flange is formed a rim, which projects laterally, but affords sufficient space for the insertion of the pipe and for the flange on it to pass through. Thus when the pipe is passed through the opening, and a washer is fitted over the upwardly projecting end, and made to rest upon the laterally projecting rim above described, a suitable cavity or box is formed for packing or stuffing material to render the joint water-tight. In the walls of the downwardly projecting flange are formed recesses for T-headed bolts, which are mounted therein so that the nuts thereon may be employed for forcing in or tightening up the stuffing or packing by means of an annular wedge-piece, which fits over and partly within the cavity surrounding the pipe.

Wet Gas-Meters.—Clarke, A. H.; communicated from W. Gay, of Rosario de Santa Fé, Argentine Republic. No. 15,054; Sept. 5, 1891. [6d.]

This invention has for its object to prevent the extraction of the water, by syphoning or other means, through the water supply pipe of wet gas-meters, when placed in position on consumers' premises.

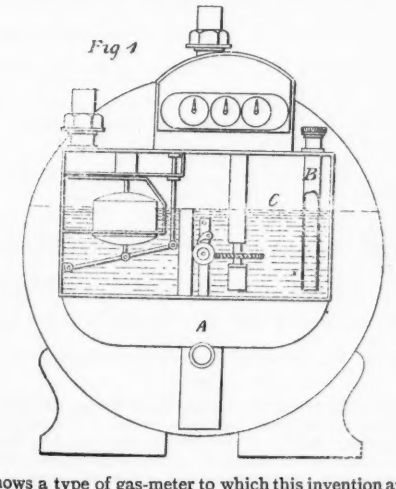


Fig. 1 shows a type of gas-meter to which this invention applies; and figs. 2, 3, and 4 are views, of various examples of the manner of carrying the invention into practice.

A is the meter, which is of any wet-type construction; and B is the pipe through which water C is introduced into the meter, and which is usually provided with a screwed plug. From fig. 1 it will be seen that, by removing this plug, and applying a syphon pump or equivalent apparatus, nearly all the liquid may be withdrawn from the meter—that is to say, all the liquid above the level of the lower end of the

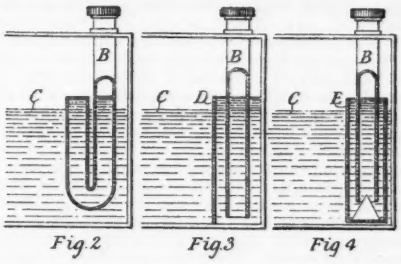


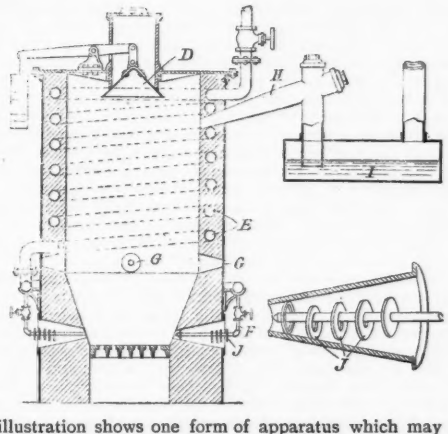
Fig 2 Fig 3 Fig 4

tube B. But figs. 2, 3, and 4 illustrate three different examples of the manner of carrying the present invention into practice. According to fig. 2, the tube B is bent so that the upper end of its leg projects above the normal level of the liquid C; or, as in fig. 3, the tube B is caused to dip down into a case or box D, the upper end of which is above the normal level of the liquid. It will be seen that, in either of these examples, when the liquid is poured into the meter through the pipe B, it will flow over what virtually constitutes the effective end of the tube, which will remain full of liquid, as shown. Should there be any attempt to withdraw the liquid from the meter, it would only result in the emptying of the end tube; the main body of the liquid in the meter remaining unaffected.

In fig. 4 the pipe B is shown as dipping down into a moveable or floating vessel or case E, the bottom of which carries a conical valve, adapted to close the lower end of the pipe when there is any attempt to withdraw the liquid through it. When liquid is poured into the meter through the pipe B of fig. 4, it fills the vessel E, and flows into the meter body over the upper edge of E, which edge virtually constitutes the effective end of the pipe; and when the supply ceases, the vessel E will remain full. If an attempt to withdraw the liquid through B is made, only a comparatively insignificant quantity will be removed; because, as soon as the quantity of liquid in E is sufficiently reduced, the vessel will float and raise the cone against the end of the pipe B, so as to prevent both the further extraction of liquid and the escape of gas.

Manufacture of Gas and Ammonia.—Lake, W. R.; communicated from A. Hernim, of Springfield, U.S.A. No. 15,249; Sept. 8, 1891. [8d.]

The object of this invention is to simultaneously and continuously generate gas and ammonia from bituminous coal, shale, or other suitable fuel; and (stated broadly) this result is accomplished by introducing air and steam, or oxygen and steam—the steam being preferably, though not necessarily, superheated—into the incandescent portion of a body of fuel contained in any suitable vessel or generator. The amount of air or oxygen is regulated so as to maintain a zone of incandescence, or body of fire, of sufficient size and temperature to decompose steam and reduce carbon dioxide to carbonic oxide, while also maintaining a sufficient body of fuel at a lower temperature, beyond such zone of combustion, to allow of the formation of ammonia, and causing the gases to pass off at a temperature sufficiently low to prevent the disassociation of the ammonia.



The illustration shows one form of apparatus which may be used to carry out the process—a vertical section of the generator, and an enlarged view of the injector and washers.

The generator is made in any desired shape, preferably round, and of refractory material. It is provided with the well-known bell and hopper D, through which the fuel is fed; and holes G, through which the fuel may be stirred and broken up as desired. At a point preferably a short distance above the grate, there are a number of radial tuyers F; and into these, steam-injectors are inserted (as shown), provided with cocks or valves to control the admission of the steam. Steam is supplied to these injectors from any boiler by means of a pipe E, preferably coiled within the walls of the generator (as shown), in order to superheat the steam by means of the radiant heat. A pipe H is provided to carry off the gases produced, and to conduct them to a hydraulic main I.

If air is to be used with the steam, it is drawn in through the tuyers by means of the injectors; and the same method is employed with a steam and oxygen blast—the tuyers in this case being connected with any suitable oxygen supply. By placing the injecting tuyers just above

the grate, the patentee claims to be enabled to introduce the air or oxygen and steam to the hottest part of the fire, and to insure a more uniform distribution and complete decomposition of the steam. The necessity for shutting off the blast when cleaning the grate and removing ashes is also avoided, as must be done when the blast is introduced into the ash-pit, unless the inconvenient plan of a water seal is adopted.

Upon the injectors there are adjustable washers formed with holes of different sizes; and when it is desired to control the amount of air or oxygen admitted, one of the washers is pushed inwards, and only so much air as can pass between the injector and the washer is admitted. If it be desired to lessen this amount, another washer having a smaller hole is pushed inwards; and so on.

The apparatus being constructed as described, the process is carried out in the following manner: Bituminous coal, shale, or other suitable fuel is introduced through the hopper and ignited, and allowed to burn until a bed of incandescent fuel 5 or 6 feet in thickness is formed. At about the same time a blast of air or oxygen and superheated steam is admitted through the tuyers. The producer is then gradually filled up, until the coal reaches a depth of from 10 to 12 feet; the upper portion of this charge consisting of green coal drying and partially distilling. In this portion, or "black zone," the temperature is not allowed to rise above 350° C. (being regulated by feeding in fresh fuel as required); and most of the liquid hydrocarbons of the fuel are here driven off. Immediately below this zone lies a zone of a higher temperature, in which the volatile matters of the coal are distilled. The temperature of this zone of distillation varies from 350° to 700° C. Here, practically, all the volatile matters are distilled; and a percentage of ammonia is formed equivalent to about 20 lbs. of sulphate per ton of coal consumed. Any steam arriving at this zone of distillation is decomposed, forming carbonic oxide, carbon dioxide, and hydrogen; and the nascent hydrogen unites with the nitrogen of the coal to form an additional amount of ammonia. The amount of carbonic oxide produced in this zone is below 50 per cent. of the amount of carbon dioxide, since the temperature, although sufficiently high to decompose steam, is too low to convert all of the CO_2 into CO, which reaction commences at 550° C., and is only complete at a temperature of 1000° C. Below this zone of distillation lies a still hotter zone, the temperature of which is 700° to 1000° C.—the "zone of combustion." It is into this zone that the steam or oxygen or air are introduced as above stated. In this zone, a large amount of steam is decomposed; half of the fixed carbon of the coal being thus oxidized, setting free an equivalent amount of hydrogen, and by then properly regulating the supply of air or oxygen the remainder of the carbon is oxidized, raising the temperature to the point proper for the reduction of the CO_2 to CO. Al the nitrogen of the fuel is, by contact with the nascent hydrogen, set free from the fuel, and converted into ammonia. The hot zone in which these reactions occur does not exceed, say, a few inches; and the ammonia formed there is instantly removed by the action of the exhauster, along with any steam remaining undecomposed, to a region already cooled by the reduction of CO_2 into CO, and mostly secured in the upper zone, where decomposition of ammonia cannot occur, owing to the low temperature, and where all the steam remaining is decomposed.

The patentee claims that he has, by means of this process, with very crude and imperfect means of separating the ammonia from the gas, obtained ammonia equivalent to about half the nitrogen contained in the coal, and simultaneously therewith obtained a fuel gas of the following composition:—

CO_2	6·50
CO	29·00
CH_4	2·25
H.	43·00

(Experiments at the time showed that still more ammonia was formed but escaped, owing to the imperfect condensation.) This gas is practically free from undecomposed steam; and it possesses the proper qualities of a high grade of gas for heating and metallurgical purposes—one of the main points of the process.

In alluding generally to his proposal, the inventor says: "As far as I am aware, I am the first to accomplish the conversion of 50 per cent. or more of the nitrogen of the coal into ammonia, under conditions which would allow of the reactions which take place in my process, especially the conversion of the CO_2 produced in the zone of combustion into CO, and thus enabling me to produce simultaneously with the ammonia a gas very low in carbonic acid (CO_2) and high in carbonic oxide (CO). The greatest care must be taken to regulate the temperature of the various zones. If the temperature rises too high, no ammonia will be formed; or if formed, will be immediately disassociated by the heat. The ammonia and gases are allowed to pass off at a temperature low enough to prevent the disassociation of the ammonia. They flow through the pipe H into the hydraulic main, from whence they are drawn into any of the well-known apparatus for separating the ammonia, removing the tar and other impurities. I am aware that in previous gas processes, air has been used to blow up the fire; and that, after a sufficient bed of incandescent fuel has been formed, the air has been shut off and steam admitted to the fire and decomposed. Furthermore, that air and steam have been simultaneously admitted to the fire. But in these processes the gases that first pass off from the fuel are generally burned, or used to heat a separate chamber, to which the gases created by the decomposition of steam, &c., are to be admitted, for the purpose of fixing or permanently combining them through intense heat. As this is precisely what I desire to avoid, I use no superheating or fixing chamber; nor do I consume the gases first coming off the coal, since I desire to preserve and utilize these gases, which are among the most useful products of the distillation. I am thus able to secure all the gases contained in the coal for fuel purposes; and hence my process will produce more gas per ton of coal than any other now known. The object of the former process has been to obtain a fixed combined gas for illuminating and other purposes, and in order to do this, intense heat has been necessary both in the generator and in the retort or fixing chamber: whereas, my object being to simultaneously produce ammonia and gas, I dispense with any retort or fixing chamber, and, using merely the simple generator, I so control the temperature at different points thereof as first to decompose the steam and reduce the carbon dioxide (CO_2), second to allow the ammonia to form, and lastly prevent its disassociation. If any ammonia has been made in the former processes, for the production of gas other than the retort or illuminating gas process, it has been a bye-product produced unintentionally and almost accidentally, and has been at once destroyed by the heat that was necessarily used to accomplish the purpose of the inventions. Its formation was a thing rather to be avoided than sought; and, if formed, it must at once be destroyed. In the majority of prior gas processes, ammonia could never be formed at all, and if formed, it would last but an instant, and then be destroyed as above stated, so that the operator would be in ignorance of its formation, and no advantage could be taken of it. In the ordinary process of making illuminating gas in closed retorts, a certain percentage of the nitrogen of the coal combines with hydrogen and forms ammonia, which is collected in the scrubbers and purifiers, but the larger portion of the nitrogen still remains in the coke and is lost. In all previous fuel gas processes, the ammonia has been neglected, if not altogether lost sight of. As stated before, it has either never been formed or at once destroyed. I have, however, discovered, after careful investigation and experiment, the possibility of so controlling the operation of the generator that ammonia can not only be made simultaneously with the fuel gas and separated from it without detriment to the quality of the gas, but that the nascent hydrogen of the decomposed steam unites with most of the nitrogen, which would be lost in the coke of the retort gas process. I am thus able to secure as a bye-product from three to four times as much ammonia per ton of coal consumed as is secured by the retort gas process. The low temperature which I maintain in the coolest zone of the generator, where the gases escape, also enables me to secure, at the same time with the ammoniacal liquors, a considerable quantity of tar of a superior quality; thus adding still further to the value of my bye-products."

Gas-Motor Engines.—Evers, M., of Leeds. No. 17,364; Oct. 12, 1891. [8d.]

This invention relates to the construction of an automatic or self-acting admission-valve for controlling the supply of explosive fluids into the cylinder of a gas-motor engine, and for thoroughly mixing such fluids so as to ensure perfect homogeneity during the admission into the cylinder prior to compression and ignition in the ordinary manner, whereby it is claimed that "great certainty of ignition and explosion is secured, combined with perfect combustion of the entire explosive compound."

In conjunction with the automatic valve, a deflecting-plate (rather less in diameter than the cylinder) is applied, fixed over the admission-valve, for limiting the distance that the valve will open, and for the special purpose of deflecting the explosive gases, during admission, so as to clear away from the bottom or rear end of the cylinder the residuum of previous explosions, and for ensuring the presence of an ignitible compound when compressed up the ignition-tube, which is located about the level of, or in the same plane as, the deflecting-plate. The action of the valve is automatic, and will fulfil the above conditions whether the engine be running quickly or slowly; and it may be applied either to a vertical or horizontal engine.

The engine, when fitted with this valve, may be governed by a bell-crank or T lever hit-or-miss arrangement. Or where great steadiness and uniformity of motion are essential, a revolving governor arrangement can be applied for increasing or diminishing the quantity of air per explosion admitted into the cylinder and producing a correspondingly more or less powerful explosion. Thus, while giving an explosion every alternate revolution, such explosions are of varying power responding to the variations in the air supply, which (as already stated) can be controlled by the governor.

APPLICATIONS FOR LETTERS PATENT.

22,292.—Yeadon, J. A., and Adgie, W., "Heating retorts or furnaces for the distillation of coal or other analogous purposes." Dec. 21.

22,325.—Mills, B. J. B., "Meters for liquids or gases under pressure." A communication from T. Blein and E. Béraud. Dec. 21.

22,347.—Rowland, W. L., "Recovering cyanides from coal gas." Dec. 22.

22,405.—Johnson, G. W., "Gas connections for use in theatres." Dec. 22.

22,451.—Christmas, E. C., and Warren, A. G., "Increasing light given by gas-burners." Dec. 23.

22,530.—Walmsley, W. E., "System of hot water heating by gas or oil." Dec. 24.

22,539.—Bradley, H. W., and Crossley, F. W., "Gas and oil motor engines." Dec. 24.

22,549.—Fritz, F., "Workmen's and other gas-lamps." Dec. 24.

22,559.—Leigh, H. H., "Gas and petroleum engines." A communication from P. F. Forest and G. Gallice. Dec. 24.

22,591.—Phythian, A. T., "Gas-taps." Dec. 28.

22,612.—Padgham, G. H., "Gas and petroleum engines." Dec. 28.

22,615.—Barclay, A., "Gas-engines." Dec. 28.

22,662.—Anderson, T. R., "Gas-fittings." Dec. 29.

22,737.—Cowan, W., "Gas governors, and means for enabling them to vary their load and pressure to suit changes in the demand for gas." Dec. 29.

22,819.—Cooper, W. C., "A reflecting and ventilating gas-lamp.' Dec. 31.

22,828.—Meldrum, J. J. and T., "Supply of liquor to ammonia stills." Dec. 31.

22,834.—Seck, W., "Gas and hydrocarbon engines." Dec. 31.

A Guaranteed Dividend of Ten per Cent. for an Electric Lighting Company.—The *South Wales Daily News* says: "A Company, having for its object the lighting of the town of Pontypool by electricity, is being formed. As the Local Board cannot obtain the necessary powers for nearly two years, the Company will at first be a private one, to be eventually transferred to the Board at the original cost; and the profits made will then be spent on improvements in the town. The most gratifying feature is that the Directors are in a position to guarantee a dividend of not less than 10 per cent.; the project having been most warmly received, and the promises of support already given more than sufficient to ensure this desirable result."

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

"Though Lost to Sight, to Memory Dear."

SIR,—At the close of a year, one naturally takes stock of anything left undone or still obscured. In the latter alternative, there are two matters which some time ago had considerable prominence in the JOURNAL, but which have gone latterly out of sight, while apparently in a state of embryo. We are now approaching the season when we must begin to "put our house in order;" and we naturally wish to be informed of all accomplished beneficial facts, and what we may expect in the way of enlightenment from the various suns and stars that have hitherto enlightened our mental darkness.

From the foregoing prologue, may I ask, What has become of the Dinsmore process? There have been gossips of trials of it, large and small, being made in several localities subsequent to the grand results of it which you published three years ago; but authenticated reports of the results obtained, I do not remember to have seen. Also what has become of that secondary planet that struck off, and so brilliantly shone in your pages, a year ago, and was to eclipse its parent sun—I mean the offshoot from The Gas Institute. Like its prototype "that rules the night," it was to make its orbit in a much shorter time than its dull parent; and we were to have had the benefit of its mental refulgence at much shorter intervals of darkness, which gave us great hope that all erratic sparks (which like earthquakes create much rumbling noise, but give little light) had been peacefully composed into separate and regular motions, in which previous collisions would be avoided, and the two orbs as they passed each other, at a respectable and safe distance, would be able to say "good day" to each other as they passed, with at most a stiff sataric bow to each other occasionally.

I have thought for some time that a physical law which some say rules the motion of our earth round the sun, may also rule the future of The Gas Institute and its planet. It is said that the centripetal will overcome the centrifugal force; and our world will go dash into the arms of its parent (if it has arms) after the untellable millions of years of its wanderings, and be again reunited into one homogeneous mass. Should a mental centripetal force be now acting on the wanderer in this instance, I can vouch that the parent has arms—strong arms—and will doubtless hold them out wide enough, and like some carnivarous plants we read of, absorb it into its very midst.

35A, *Great George Street, S.W., Jan.* 8, 1892. GEORGE ANDERSON.

Photometry and the Standard of Light.

SIR,—I am glad you have thrown open your columns, to all whom it may concern, for the discussion of the above questions. I may at once admit that I never was an admirer of the present system of photometry. The photometer is far too scientific an apparatus to be fully appreciated; and I think I may venture to say that in nearly three cases out of every four where gas companies, corporations, local authorities, or private individuals are compelled to have photometers, either by their Acts of Parliament or Provisional Orders, the instrument is more ornament than use. It may be all very well for large gas companies, who are able to employ a thoroughly good man, well acquainted with photometry. But, in my opinion, the photometer ought to be an instrument as easy to be understood by the novice as by the scientist, just as a yard measure is to the great town merchant and to the village shopkeeper; and until this is done, it is nothing but red-tapeism for the Board of Trade to grant Provisional Orders to small gas companies, and compel them to purchase and keep up an instrument of which the manager has neither time nor talent to make use. I have never used pentane, and therefore I cannot speak upon its merits as compared with candles; and as the latter are a questionable standard, as shown by the correspondence which has already taken place in your columns, why should I be compelled to employ them?

It is strange if, among all the clever men in the gas profession who have studied photometry, they cannot devise a simple instrument, which, by turning on a tap, enables the quantity of light to be registered. Mr. W. Sugg once brought out a meter photometer which was exceedingly simple. I suppose it had its defects; but it was admired for its simplicity. It is an appliance of this nature that is wanted to satisfy—shall we say "the submerged truth?" If an instrument could be so designed as to dispense with candle standards, and substitute numbers—the light to have a certain penetrating power—it would be an advantage. Let us suppose a standard burner, consuming 5 cubic feet of gas per hour, burning within a case (say) 8 or 10 inches in diameter, with sufficient air admitted from the bottom, and a tube to take away the products of combustion from the top. Let there be at the side an opening, and a tube (say) the same size as the ordinary disc, and in the tube slit holes to admit of discs, each disc representing 1 candle, ½ candle, or ¼ candle, which could be added one by one until the light was totally obscured. Let anyone take sheets of writing-paper, and place one between himself and the light, and then add sheet after sheet until he found the light totally obscured, and he will get a rough notion of my idea.

At any rate, I throw out the above suggestion, hoping that someone may improve upon it, and that it may lead to the introduction of a much more perfect and a simpler instrument than the present one.

Penmaenmawr, North Wales, Jan. 7, 1892. R. DEMPSTER.

A Water Supply Scheme for Bath.—The Town Council of Bath are considering an important scheme for increasing the supply of water, which at dry seasons is found insufficient to meet the growing needs of the city. The Water Committee have presented an exhaustive report, in which they recommend the purchase, at an estimate of £17,650, of springs at Marshfield; an alternative proposal being the construction of an immense storeage reservoir at Monkswood, capable of furnishing a supplemental yield of about 400,000 gallons a day for 120 days. The Council, by a substantial majority, have favoured the acquisition of the springs, on the grounds of the certainty in the actual increase of supply, the quality of the water obtained, and the ease with which it could be delivered to the higher levels.

MISCELLANEOUS NEWS.

MR. T. CANNING'S LECTURES ON COAL GAS.

The Domestic and Industrial Applications of Coal Gas.

The last of the course of lectures by Mr. T. Canning, Engineer and Manager of the Newport (Mon.) Gas-Works, to the members of the Young Men's Friendly Society in that town, was given on the 28th ult.; the above being the subject selected. The previous lectures were reported in the JOURNALS for the 22nd ult. and the 5th inst.

The lecturer commenced by describing the application of coal gas as an illuminant; dealing first with the question of domestic and street lighting. For illustrating his remarks, he had arranged before him, on a wrought-iron horizontal tube, a series of burners of nearly every general shape and character, from the antiquated iron fishtail up to the most highly-developed modern burner. Several handsome meters were attached, in order to show the quantity of gas consumed; thus giving the audience full opportunity of judging of the value of each burner, and bringing into very bold relief the importance of using proper ones, in order to obtain the highest amount of lighting power possible from a given volume of gas. The difference between a burner having a governor, and one not furnished with this appliance, was also well demonstrated; and the capability of gas to effectually yield as brilliant a light as could be desired, was also illustrated by the Argand and high-power burners exhibited—Mr. Canning briefly explaining the construction and adaptability of each type.

The lecturer next referred to the competition between gas and electricity. This competition might, he said, be summed up in two words—cost and convenience. The cost of electricity could not in reality be known with any certainty at present, as no two electricians were agreed upon it. With respect to measurement, the Board of Trade unit was the measure for electrical energy. This was 1000 watts. Now, 746 watts represented in energy 1-horse power; therefore the Board of Trade unit was equal to 1⅓-horse power. In respect of the generation of electrical energy, one electrician would state that it required only 8 lbs. of coal per unit; while another would go as high as 22 lbs. per unit. Of course, this difference might arise mainly from the quality and arrangement of the machinery, particularly the boiler plant used in the work of generating electricity. In regard to the distribution of electrical energy, there were two systems, which the lecturer explained—the low-pressure direct current, and the high-pressure alternate-current system; and he asked if electricians were really agreed as to which of these was the better. Could any electrician tell the cost of maintenance with the latter system, the wear and tear of transformers, and the preservation of insulation? For the Board of Trade unit a charge of 8d., and in one case 7½d., was generally made. Was this too much or too little? Mr. Canning said he would not venture to answer the question, but would simply observe that no great profit seemed to result from this price. Electricians, however, particularly Mr. Preece, would say the light was still nearly as cheap as gas, as it gives a higher candle power. He would follow Mr. Preece, and take a shilling's worth of gas and a shilling's worth of electricity, and compare the two. At Newport a large proportion of the gas was sold at as low as 2s. 10d.; but, for convenience, he would take 3s. per 1000 cubic feet. For 1s. at Newport there were obtainable 333⅓ cubic feet of 16½-candle gas, yielding, in round numbers, the light of 1000 candles when properly consumed. Taking Mr. Preece's own statement, that the Board of Trade unit yields 333 candles, then at 8d. per unit this would be 495 candles for 1s., or less than half the number of candles' light given by the Gas Company for the same money. He (the lecturer) wished it to be understood that he did not accept, save for argument's sake, the statement that the Board of Trade unit would give 333 effective candles per hour; and instead of considering that electrical energy cost for lighting purposes only twice that of gas, he thought it was about 2½ times as much. For a 16-candle light a gas company charged about 0·2d. per hour; while for the same light electricians charged 0·5d. He introduced Mr. Preece's name particularly because, first, he was an eminent electrician; and, secondly, because, notwithstanding his advocacy of the electric light, he was a large, and avowedly firm, gas shareholder. Electric lighting was used in the Pullman cars, but not in the third-class carriages on our railways; in the state cabins of ocean mail steamers, but not in the sorting department; in the drawing-room, but not in the shop. It was, in short, a light of luxury and novelty.

Mr. Canning then referred to the use of gas as fuel, and its application for purposes of cooking. He illustrated his remarks on this subject by a gas-fire at work in the room, consuming about 11 cubic feet of gas per hour. This would, in the first hour, raise the temperature of an ordinary sitting-room 11° Fahr., or 1° for each cubic foot of gas consumed. In regard to cooking, he explained that five joints of 8 lbs. each might be cooked for 3d. worth of gas; and a joint of 8 lbs., for about 0·6d. Another use of gas for fuel was, he said, in regenerative furnaces, which had been applied to glass-works, gas-works, steel and iron works, and in various other industries. Gas was the light of the nineteenth century; and everything showed that it would be the light and fuel of the twentieth. The lecturer also alluded to the great use made of compressed gas for lighting buoys; instancing as examples the buoys on the Suez Canal, and those employed by the Trinity House. The latter were spherical, 9 feet in diameter, carrying a little wrought-iron frame on the top of which was a small lantern. Gas was compressed to about five or six atmospheres, and lasted something like 100 days, when the buoy would be charged afresh. The value of gas in illuminating light-houses, and its power to penetrate fogs, were well known. One ingenious application of gas—viz., that of lighting railway carriages—was first adopted in 1871 on the Lower Silesian Railway, and introduced on the Metropolitan Railway, London, in 1876. It had since been adopted on many other lines. The small gasholders are attached either to the roof or to the under framework of the carriage; the pressure being from 6 to 8 atmospheres. From these holders the gas is passed through regulators to the burners. On the London and North-Western Railway, two small holders, of the combined capacity

of 27½ cubic feet, light a six-wheeled first-class carriage by means of seven burners, each consuming 0·4 feet per hour. These two holders, charged at Euston, at a pressure of eight atmospheres, do not require re-charging until they return thence from Aberdeen; the whole distance covered being 1080 miles. Generally speaking, there is a pressure of 20 lbs. on the square inch left on their return.

Mr. Canning closed his remarks by stating that one of the greatest industrial applications of coal gas was for motive power in the gas-engine; and for the production of energy, it was, so far as it had gone, in no way behind any other motor in efficiency.

During the evening the lecturer, assisted as before by Mr. J. H. Canning, performed a large number of interesting experiments. It may be mentioned that the gas appliances exhibited were manufactured by Messrs. W. Sugg and Co., Messrs. T. Fletcher and Co., Messrs. J. Wright and Co., the Gas-Meter Company, Messrs. W. Parkinson and Co., Messrs. W. and B. Cowan, and some other well-known makers.

A hearty vote of thanks was accorded to Mr. Canning for his lectures.

BIRMINGHAM CORPORATION GAS SUPPLY.

The Sale of Coke—The Fittings Department.

At the Meeting of the Birmingham County Council last Tuesday—the MAYOR (Mr. Lawley Parker) presiding—the Gas Committee's report, of which we gave the principal portions in last week's JOURNAL, was submitted.

Alderman POLLARD, in moving the adoption of the report, said the Committee had made a concession to the workmen in their employ by reducing their hours from 54 to 53 per week, by allowing them to terminate their work at twelve o'clock on Saturdays, instead of one. In doing this, they were following the example set by many large manufacturers in Birmingham. Some minor concessions had also been granted, which had given great satisfaction to the men. The cost of these changes would amount to about £700 per annum; but the Committee had consulted the other principal Committees employing labour—such as the Water, Public Works, and Health Committees—and had found that the concessions made would not interfere with them, as the conditions under which their labour was employed were different from those which obtained in the Gas Department. The Committee, he went on to remark, had provided prepayment meters in the houses of terraces where gas had been provided, with the result that there was now a far larger number of consumers, and the amount of gas burned by each had been considerably less than in former times—thus showing that greater economy was studied where the prepayment meters were used. With regard to the storeage of coke, there had been a great accumulation. In May and July last, he called attention to the fact that the Committee would have to accumulate a larger stock of coke than usual, because of the failure of some of the trades to take the quantity of coke they had been accustomed to purchase. The amount in stock, however, was but a very small proportion of the quantity they manufactured in the course of the year. The sales of coke in Birmingham had not decreased—in fact, they were selling more in the city than previously. There had been a reduction of 2s. per ton in the price, because of the fact that some manufacturers of gas found it convenient to send their coke into Birmingham, and sell it at almost any price to get rid of it. He did not think there would be any necessity to further reduce the price at present; and they would be able to dispose of the present stock as well as the winter-made coke. The revenue from coke fluctuated considerably. In 1885 the revenue was £39,000; in 1886, it fell to £34,000; in 1887, it was the same; in 1888, when trade improved, it rose to £44,000; in 1889, it increased to £60,000; and during the last financial year, from March, 1890, to March, 1891, the revenue was £91,400, or nearly three times as much as in 1885. Between April 1, 1890, and March 31, 1891, they made about 245,000 tons of coke, of which quantity they used 55,000 tons at the works, and had for sale 195,000 tons. This year they would probably have for sale 220,000 tons. He wished to point out that a reduction of 1s. per ton in the sale of coke meant a decrease in their revenue of £11,000, or about 1d. per 1000 cubic feet in the price of gas. The question of coke was a matter of great anxiety to the Committee; for they relied upon the revenue from coke to meet the additional expenditure for coal and wages. If they could not rely upon it, it would be necessary to increase the price of gas; but the Committee would endeavour not to be obliged to follow the example of other gas companies, and raise the price of gas. The price of gas in part of London, for instance, at present was 3s. 1d., against an average of 2s. 3½d. in Birmingham; and in Liverpool it had been increased from 2s. 8d. to 3s. There was an increase in the consumption of gas during the six summer months; and in October and November, there was also a slight increase. But December proved an unprofitable month, because they had to compare the mild weather of 1891 with the very severe cold of 1890. The falling off was considerable before and after Christmas; but there was one week during which the consumption was 3,250,000 cubic feet more than in any week in 1890. On Christmas Eve the consumption was very large, owing to the fog and cold weather which prevailed. It was almost too great for their production; and they had to rely on the indulgence of the public in being compelled to reduce the pressure, in order that they might not be without gas in the evening. They would not have been placed in this predicament if the additional works authorized by the Council at the last meeting had been completed; but, unfortunately, they were not quite finished.

Mr. WILKINSON thought if the Committee could bring the price of coke within the means of artizans, the demand for it would soon be equal to the quantity produced. He had heard of coke being purchased from outsiders at 7s. 9d. per ton; whereas in the city the price was about 14s. a ton. This seemed most unreasonable. Four firms within half a mile of the Saltley Gas-Works used something like 5500 tons of coke every year, which was imported from different gas-works; and there were other firms in Saltley which used 2000 tons a year. These firms would use Saltley coke if they could get it as cheaply as they could away from Birmingham.

Mr. BARCLAY said he noticed that the Sutton Coldfield Corporation were promoting a Bill to enable them to supply their own gas. He would like to know what effect this would have on the Birmingham Gas Committee.

Mr. JACOBS protested against the fittings department being continued as a competitor with other traders.

Mr. BLOOR, having thanked the Committee for the concessions they had made to the gas workers, said he had heard that some firms were supplied with coke by the Gas Committee at contract prices of 8s., 8s. 6d., and 7s. 9d. per ton. If the Committee could supply large firms at these rates, surely they could reduce the price to householders.

Alderman ASH complained of the dirt which was allowed to accumulate with the coke, and pointed out that, in stacking the coke to such a large extent, it was badly crushed, and therefore not so profitable. The consequence was there was a waste of money in permitting such an extensive accumulation of the coke. In his opinion, it would be far better to sell it a cheaper rate than allow it to perish in stock.

Alderman KENRICK, in reply to Mr. Jacobs, said the fittings department was not so much a competitor with other traders as a museum for the instruction and convenience of ratepayers and consumers. He hoped the fittings department would never be given up.

Mr. GREEN said the matters referred to by Alderman Ash had been considered by the Committee; but they were obliged to stock a certain quantity of the coke for the winter.

Mr. BEALE said that, if there was a strong feeling on the part of the ratepayers that the fittings department ought not to exist, they could shut it up. It could not exist unless it was found to be a convenience. There were something like 13,000 or 14,000 small accounts in the department, say, averaging a pound apiece; and this fact showed that the department was regarded as a convenience.

Alderman POLLACK, in reply, said that the Committee had not sold less coke to the inhabitants than last year—rather more, in fact. They were compelled to follow the price of coal to some extent. No doubt the man who took great quantities of coke during the year had it at a cheaper rate than the very small consumer. Of course, the price of coke could be reduced if the Council desired it; but this would mean an increase in the price of gas. It was a mistake for Mr. Jacobs to say that the fittings department of the Corporation should be abolished. The Sutton Coldfield Corporation were trying to acquire the gas supply in their district. The Gas Committee would not oppose the application to Parliament; but the interests of the city in the present supply of gas to Sutton would have to be purchased out. A certain sum had already been mentioned as the value of those interests; but the Committee did not consider it at all an adequate amount.

The report was then adopted.

EXTENSION AT THE WEST BROMWICH GAS-WORKS.

At the Monthly Meeting of the West Bromwich Town Council last Wednesday—the Mayor (Mr. G. Salter) presiding—the Gas Committee presented the following report: "In consequence of the difficulties in obtaining the plot of land on the Mill Farm estate, adjoining the gas-works, for the erection of a gasholder thereon, the Committee have, after due consideration, made certain modifications in the scheme of extensions as submitted for approval to the Council in May last. As reported to the Council at the last meeting, it has now been decided to erect a gasholder in the gas-works yard, of a smaller capacity than that which was intended to have been put upon the land above referred to. It has also been decided to make certain alterations and enlargements to the existing retorts, recommended by the Manager (Mr. Littlewood), and so defer building an additional retort-house. The Manager estimates that these enlargements will have the effect of increasing the productive power of theretort-house by 11 per cent., and will therefore place the Committee in a position to meet the demand for gas for several years to come. The cost of the retort-house alterations will for the most part be chargeable to revenue; only a small proportion being chargeable to capital. The modified scheme of extensions as now recommended to the Council for approval is as follows: Proposed new gasholder, £8000; additional purifiers, £2640; additional scrubber, £600; stoking machinery, £2500; additional boiler, £320; additional condensers, £500; additional meter, £1050; sulphate of ammonia plant, £1000; alterations to retorts (proportion chargeable to capital), £100; and coal-testing apparatus, &c., £200—total, £16,910. Adding to this £3090 for contingencies and further outlay, makes £20,000. The Committee therefore recommend the Council to apply to the Local Government Board, under the Provisional Orders Confirmation Act, 1886, for sanction to borrow the sum of £20,000, instead of £33,310, as submitted by the Committee at the meeting of the Council in May last." Alderman Farley, in moving the adoption of the report, explained that the Committee did not intend to expend all the £20,000 at once; but to spend it from time to time as the circumstances require it. Mr. Keys seconded the motion, which was carried.

Fatal Accident at the Huddersfield Gas-Works.—On Christmas Day, Christopher Kenny (aged 30), a labourer, met with an accident at the Leeds Road Gas-Works of the Huddersfield Corporation, which resulted in his death. It appeared that the deceased was engaged in wheeling ashes from the retort-house into the yard. Beside the doorway of the retort-house was a lift, about 6 feet square, and 9 ft. 6 in. deep. On the morning in question, there was ice near the lift, caused probably by the water dropping from the barrows; and it is supposed that Kenny slipped on the ice, and fell down the lift, where he was found badly injured by a stoker. Death occurred at the Infirmary on the following Monday, from peritonitis, arising from abdominal injuries. At the inquest, it was stated that the lift was only guarded on the side facing the retort-house; but experiments were about to be tried, and, if found practicable, an automatic guard would be put all round. A verdict of "Accidental death" was returned.

BOLTON CORPORATION GAS AND WATER SUPPLY.

In reviewing the operations of the various departments of the Bolton Corporation during the past year, a local paper says that, under the constant care of the Gas Committee, the high standard of efficiency which has so long been maintained in connection with the gas-works, continues to be sustained; and wherever improvements can be introduced to facilitate the production of the "lighting medium" in a manner both efficient and economical, they are adopted. Two or three changes have been recently made at the Lum Street Gas-Works. In the retort-house were originally four benches of retorts. Nos. 1 and 2 have been pulled down; and in their place a new bench upon the generative principle has been erected, embracing 288 mouthpieces. The condensers at these works have been doubled in height to meet the requirements of the extra production by the adoption of the new system. The connections to the scrubbers have also been re-arranged, and their diameter increased; and the scrubbers are now doing their work very effectively. At the Gas Street works a large new tar and liquor tank has been completed in a satisfactory manner. It will perhaps be of interest to mention here, as illustrating the producing power of the works, that during the 24 hours from six o'clock on Thursday morning, Dec. 24, 5,493,000 cubic feet of gas were consumed; this being considerably more than the highest previous record for 24 hours —4,800,000 feet—a few weeks ago. Rather more than a year since, the Corporation commenced to supply gas by prepayment meters, and a large number of these are now in use. There are also at the present time 684 gas cooking-stoves, 403 gas-fires, and 129 breakfast grillers out on hire.

Dealing with the affairs of the Water Department, it is mentioned that the new reservoir at High Rid, Heaton, is now on the eve of completion. It has a capacity of about 100 million gallons of water; and it is expected that it will be ready for use within the next three months. Another important feature in connection with this department is the extension of the water supply to the township of Atherton, which has been hitherto provided from the Manchester Corporation Water-Works, but has now been undertaken by the Bolton Corporation at the request of the Local Board. The arrangement between the Corporation and the Local Board provides for a supply of water in perpetuity; the minimum being 50,000 gallons per day, and the maximum 100,000 gallons. The Heaton and Sharples drifts are now both completed; and by their agency an enormous supply of excellent water is regularly obtained from the Horwich and Belmont hills. Another big piece of work is the repair of the waste-water channel in connection with the Wayoh Reservoir, and which is now in progress, about 6000 square yards of new paving having to be done, and nearly 4000 cubic feet of ashlar sill stones to be put in, besides the renewing of the concrete work. The present stock of water in the whole of the reservoirs amounts to nearly 1030 million gallons.

HEYWOOD CORPORATION GAS AND WATER SUPPLY.

Extensions at the Gas-Works—The Position of the Water Supply.

In the course of a review of the municipal affairs of the borough during the past year, the *Heywood Advertiser*, referring to the Gas Department, remarks that it is pleasing to find that there has been an increased consumption of gas both for motive power and for cooking purposes. To meet this demand, and the increased consumption created by the growth of manufactures, there have been various alterations and extensions at the gas-works. These include the taking out of two old steam-boilers and two exhausters, and replacing them with new ones, which are larger and better adapted for their work in every respect. A portion of the old engine-house has been taken down, and a larger engine-house substituted; and a new boiler-house and stokers' kitchen have been erected. To meet the deficiency of capacity which has been experienced, a new holder has been constructed; and an old tank has been repaired and utilized for this purpose. The work was much retarded by the extremely wet weather which prevailed during the whole of the summer and autumn; but the holder has been brought into active use during the past few weeks. This increased holding capacity has not been provided one whit too soon—in fact, the wet weather prevented its completion soon enough; for during the intensely dark and foggy days a month ago, the supply of gas at the works was on one evening practically exhausted, and extra men had to be called on from the other "shifts," and special efforts made to manufacture gas as quickly as possible regardless of quality, the supply for some hours being literally from hand to mouth. The new holder will prevent any such risk in future, even when the mills now in course of construction are at work, because their demand does not last for many hours each day. The profits during the year on the Gas Department were reported at £901.

As regards the Water Department, the annual report of the Engineer (Mr. James Diggle, C.E.) shows that there is now at Clay Lane and Naden an increased storeage capacity of a million gallons per day, or sufficient water to meet the requirements of 50,000 people during the greatest drought on record. The increased supply of water is one of the great features of the year; because, although there have been complaints of the excessive rainfall of the latter part of the year, the early months were decidedly dry—so much so that, while the people in Heywood were revelling in an abundant supply of beautiful soft water early in the spring, Bury and some other neighbouring towns were being put on "short commons" in regard to that necessary of life. The receipts for water sold during the municipal year amounted to £15,129, or more than those for the corresponding year by £384.

The Water Supply of West Bridgford.—A Syndicate of owners and ratepayers of West Bridgford has been formed for the purpose of boring for water; and they have engaged Mr. W. H. Radford, C.E., of Nottingham, to advise them. This step has been taken in opposition to the proposal that the district should be taken within the limits of the Nottingham Corporation water supply.

THE ELECTRIC LIGHTING SCHEME FOR CAMBRIDGE.

An inquiry has recently been held at Cambridge by Colonel J. O. Hasted, R. E., one of the Inspectors of the Local Government Board into an application by the Corporation for power to borrow money for purposes of electric lighting. The Town Clerk (Mr. J. E. L. Whitehead) opened the proceedings by stating that the Corporation asked permission to borrow £35,000 for the scheme. The present indebtedness of the Corporation was between £56,000 and £60,000; and although they might have a sewerage project looming in the distance, which might cost £150,000, he did not think the Local Government Board would prevent them obtaining the loan for electric lighting if they thought desirable. Professor Garnett proceeded to give details of the scheme proposed to be adopted. He explained that the generator which they intended to use was a Parsons steam turbine, driving alternate currents of 2000 volts; and also that a complete system of secondary mains would be laid down throughout the entire length of the route covered by the primary mains with, for the present, a few exceptions. His estimate for immediate expenditure was £24,300; but he had recommended that borrowing powers should be obtained to the extent of £35,000, because that would enable the system of conductors to be extended if the demand arose. Mr. Mollison said that Professor Garnett had estimated the net profit on a capital expenditure of £30,000 to be £1700; but it would seem that the Newcastle Company only obtained a gross profit of about £1500 on a capital expenditure of £22,000. He asked Professor Garnett if he could explain this great difference. Professor Garnett replied that there were two partial explanations of it. One was that the Newcastle Company had been rapidly developing, and started the year with not nearly so many lamps as they had now. But the main explanation was that the Company sold their energy at the rate of 5·05d. per unit; and in Cambridge it was proposed to charge 8d. per unit. The Master of Peterhouse spoke in opposition to the scheme. He was of opinion that the matter should be taken up by an independent company, and not by the Corporation. The Colleges would not for a long time use the electric light except for the halls and chapels; and he saw no possibility of making a profit. He hoped that should the Local Government Board decide to grant the application, opportunity would be given to consider whether the direct-current system would not be the most economical to adopt. Professor Ewing, referring to this last remark, said there was no doubt at all, from the figures which had been published by the various electric lighting companies, that for the continuous current system, the consumption of coal was only about one-half of that required for the alternating system. He would like to ask Professor Garnett whether it was not his opinion that the continuous current system was better adapted than the alternating system for the supply of the compulsory area of Cambridge. Professor Garnett replied that he was quite prepared to admit that given a central station, with a proper water supply, the compulsory district could be supplied with the direct current system under very favourable circumstances, and perhaps at a somewhat less cost than with the alternating system; but the advantages of the continuous current system were not so great as at first sight appeared. Alderman Balls, the Chairman of the Cambridge Gas Company, speaking as a ratepayer, said that at the present time the amount of loan on which the ratepayers had to pay interest was £64,318. The sewage scheme he had put down at £120,000, which, he thought, was very moderate, and then the electric light he estimated at £40,000. The total was £224,318. He would like to know whether the ratepayers were aware of the position in which they stood, and whether they would agree to support a scheme of this kind, which he must designate as an unlimited company, with power to call upon the ratepayers from time to time. He could not conceive how the scheme should meet with the approval of the ratepayers when they were told the Corporation were only about to light the centre of the town, and the ratepayers in the suburbs must wait an indefinite time before they reaped the benefit of this luxury. He did not object to a company coming in and speculating; but he protested against the money of the town being used for the purpose. The inquiry shortly afterwards concluded.

THE LONDON WATER SUPPLY.

At the Meeting of the Balloon Society, at St. James's Hall, Piccadilly, ast Friday evening, Mr. HARRY WILKINS, the Vestry Clerk of St. James's, Westminster, delivered an address on the above subject. Mr. W. H. LE FEVRE occupied the chair.

After a few introductory remarks from the Chairman,

Mr. WILKINS commenced his address by observing that few people, except possibly shareholders in the Water Companies, would regard the present position of the London Water Supply as satisfactory. Complaints were pretty frequent of arbitrary requirements, of overcharge, of insufficient supply, and of inferior quality; and yet at no period in the history of London had there been so copious, so convenient, and speaking generally, and with some reservation, so excellent a supply as now. Although he had no serious complaint to make against the Companies, he was strongly impressed with the idea that the inhabitants would be better served if the undertakings were in the hands of a public authority. Having taken a hasty glance at the history of the Water Supply of London from 1225, when a conduit for Tyburn water was erected in West Cheap, down to the inauguration of Sir Hugh Myddleton's scheme—the New River—in 1613, Mr. Wilkins said he believed the precise original cost of this work had never been published; but in the New River Company's Act of 1852, it was stated that £1,519,958 and upwards had been expended on the undertaking. This had since been increased by about 2 millions; so that the capital outlay had been greater within the last 40 years than during the previous 250 years. Next in point of date was the East London Water-Works Company, which originated in 1669. The present Company was incorporated in 1807; and the capital authorized was £380,000. It was now upwards of £1,250,000. The Chelsea Company was established in 1723, with a capital of £40,000, since increased to £1,192,645. The Southwark and Vauxhall Company had

existed in some form or other since the year 1771, but was not incorporated under its present name until 1845. The Lambeth Company was established in 1785; and the Grand Junction Water Company was an offshoot of the Grand Junction Canal Company, which obtained power in 1798 to supply water to the inhabitants of Paddington and the parts adjacent. The power to supply water was transferred to a separate Company in 1811. The West Middlesex Company was incorporated in 1806, with a share capital of £30,000, and borrowing powers to the amount of £50,000. The present capital of the Company was £1,354,916. The last of the eight Metropolitan Companies—the Kent—was incorporated in 1809, and was authorized to acquire the works and privileges of the Ravensbourne Water-Works, which had been in existence since 1701. This Company was the only one drawing a supply solely from deep-wells sunk in the chalk.

Having quoted some of the statistics given in the report for October last of the Water Examiner as to the amount of water drawn from the various sources, Mr. Wilkins referred to the quality of the water. In touching upon this question, he said he felt that he was treading upon delicate ground. At the same time, when they found that the largest community in the world had a smaller death-rate than communities much more favourably situated for health, and supplied with a theoretically purer quality of water, what conclusion could they draw, except that the water supplied to London contained nothing very detrimental to health? He wished to guard himself, however, against being supposed to assert that the supply of water from the Thames could not be improved; it was excellent, but might be better. Much of the impurity complained of resulted from the neglect of the householder to have his water receptacle cleansed from one year's end to another. Even a constant supply did not remove the necessity of periodically cleansing the cistern, if such a receptacle was used. This reference to constant supply led him to observe that the Water Companies deserved every credit for giving a constant service in large parts of their districts without any legal obligation to do so. At the present time as much as 93 per cent. of the house supplies were on the constant system in the East London Company's district; while in the Chelsea Company's area, only 23 per cent. of the houses were supplied in that manner.

The speaker then passed on to consider some of the general legislation affecting the question. The Metropolis Water Act, 1852, was first referred to; and he gave a synopsis of its principal provisions. The Water-Works Clauses Acts of 1847 and 1871 next received attention, and then the provisions of the Water-Rate Definition Act were dwelt upon. In connection with the last-named Act, he said that, in the past five years, the average increase in the rateable value of London, arising from new buildings, had been about £250,000 a year; but the increase by the recent revaluation was nearly £1,500,000, after deducting the average annual addition for new buildings (£250,000), and making due allowance for the rateable value of property not supplied with water at all, or on other terms—such as railways, tramways, docks, warehouses, factories, &c. He thought that, upon a low estimate, the Companies derived an additional income of £37,000, or an average of nearly £5000 each, solely from the increased assessment of existing buildings without coming under any additional obligation; and capitalized at 4 per cent, this represented £943,000. It would thus be seen that, if purchase of the existing undertakings was contemplated, each quinquennial assessment added a considerable sum to the capital value of the Companies' undertakings.

At some length, Mr. Wilkins proceeded to refer to the terms for the purchase of the Water Companies proposed by Lord Cross in 1880, which, he said, were open to three very grave objections—(1) Excessive price; (2) payment of annuities, instead of by redeemable stock; and (3) unsatisfactory constitution of the water authority. He then passed on to the attempt which was made to grapple with the water question last session, referring especially to the provisions of the Vestries' Bill. As he was largely concerned in constructing the scheme of this Bill, he might perhaps be pardoned for expressing an opinion that the Bill dealt equitably with the complex question, having regard, as far as possible, to the various conflicting interests. Standing in the relation that he did to the Bill, it would, he said, be unbecoming in him to criticize the action which the City Corporation and London County Council deemed it right to take in opposing it. He could not, however, refrain from saying that the course they adopted seemed to him incomprehensible and inconsistent. The Engineer of the County Council, for instance, admitted that, to undertake the supply of water without acquiring the undertakings of the Companies was not only without precedent but suicidal, and yet the Council were not willing to come under an obligation to purchase on arbitration terms, bound as the arbitrators would have been to disregard causes for inflating the value of the undertakings, while taking into account causes for depreciation. The attitude of the Water Companies on the point of arbitration was intelligible; and he did not think it was a breach of confidence to mention that an intimation was conveyed to him that, unless they accepted arbitration under the Lands Clauses Act pure and simple, the Companies would fight the clause in the Bill strenuously, if, as at one time appeared probable, the Committee found the preamble of the Bill proved.

Regarding the Bills to be presented to Parliament this year, Mr. Wilkins remarked that there were nominally three. Two of them, however, were duplicate measures; so that only two proposals would be before Parliament. As to the Bill promoted jointly by the City Corporation and the County Council, at the sole expense of the former, it so closely resembled the rejected City Bill of last year that he could not regard it as a serious attempt to settle the question, especially as in points of difference it was rather worse. As a freeman and liveryman of London, he deplored the fact that a historic Corporation should step down to the position of (he was about to say) servility—and did not know any better word to express his meaning—to a body which, he ventured to think, did not, as at present constituted, command the complete confidence of its constituents; and he deeply regretted that the Corporation of a commercial community should assist the Council in its attempts to set aside, too lightly, vested rights based upon parliamentary bargains.

Dealing with the question of purchase, he said that the profits divided by the Companies last year, including interest on debentures, was about £1,120,000; the total nominal capital, £14,500,000; and the present market value of the capital, about £33,500,000. This capital included the value of landed estates chiefly belonging to the New River Company, which were in no way essential to the water undertakings, and probably represented an asset of something like £4,000,000. Deducting this asset, the water undertakings should be acquired for less than £30,000,000. This amount in 3 per cent. stock would represent an annual charge for interest of £900,000, leaving a large margin every year to be applied to the redemption of the debt and to the unification of charges for water throughout the area of supply. But in estimating the purchase price of the undertakings, it must be remembered that they did not all stand on the same footing. One or two—such as the Chelsea Company—had already provided for all probable requirements of their district; while others were likely to come under heavy capital commitments in a very short period, with the prospect of falling dividends. Another important consideration was the fact that within 15 or 20 years existing sources of supply must be supplemented; and the cost of this was highly problematical. This fact seemed to him to be the strongest reason of all why the undertakings should be acquired by a public authority without delay.

Mr. Wilkins next commented on the various new sources of supply which have been suggested, summing up in favour of the conclusions arrived at by Sir Robert Rawlinson that adequate storeage reservoirs in the basin of the Thames would afford the best, and by far the cheapest, solution of the difficulty. With regard to the constitution of the authority to be entrusted with the water supply, he said he should prefer a representative authority elected by the Town and County Councils throughout the area; and he regretted that the Corporation of London had not seen their way to place themselves at the head of the federated municipal and county councils of greater London. Such an opportunity presented itself last year; but unfortunately it was thrown away.

At the close of the address,

Mr. Bonthrom, of the St. James's Vestry, proposed—"That in the public interest the undertakings of the eight Metropolitan Water Companies should be transferred to a public authority, on equitable terms, with the least possible delay, as the first step towards vesting the supply of water in such authority."

Mr. Trinner, of the Holborn District Board, seconded the resolution which was carried.

A vote of thanks to Mr. Wilkins concluded the proceedings.

THE WATER SUPPLY OF FLORENCE.

Our readers are aware that some months ago the Municipality of Florence commissioned Sir Douglas Galton, K.C.B., to inquire into the sanitary condition of the city, which had given rise to a certain amount of alarm. In the course of his report, which was presented last month, he gives the following description of the portion of the water supply that is obtained from outside the municipal boundary:—

There are two sources of extraneous supply—one from the Monte Reggi, from the gravel and sand beds, in which the River Mugnone runs (a tributary of the Arno), which was originally provided by the Medici, and supplied the Pitti Palace and other places on its way. This was extended about twenty years ago by one of the family of the Canta-Galli at his own expense. It is delivered by gravitation into a reservoir 60 metres above the level of the quay at Florence; but since its extension it has occasionally become turbid in times of much rain. Last year it was alleged that the contamination of this source had caused the typhoid epidemic in the city; and it was cut off. The analysis of the water made at the time did not bear out this contention. The other extraneous source of supply was constructed between 1873 and 1876. It consists of two galleries carried at a depth of some 12 feet or 14 feet below the bottom of the Arno. They start from the water-works, which are situated on the quay on the south side of the river near the Via dei Bardi. One is carried under the river bed to the opposite side, and receives water from a well situated near the Campo di Marte. The other is carried up the valley parallel to, and about 70 metres distant from, the river. Both are in the gravels and sands in which the river bed is situated. The galleries are of masonry. Water is admitted through openings in the bottom and through holes in the sides; the latter at distances of about 5 feet apart, and about 2 feet from the bottom. The part of the gallery which passes under the town has been recently made impermeable; and water is now collected only from that part, 60 metres in length, which lies under open fields above Florence. The water is pumped out by turbines, driven by the water of the Arno, into three reservoirs, at heights of 60 and 40 metres above the level of the quay, and thence distributed by gravitation. These reservoirs are capable of holding 36,000 cubic metres (about 8 million gallons). This water is always clear and good. The quantity may be said to vary from 1 to 2 million gallons per 24 hours, according to the season. At the present time, out of 12,000 houses in Florence, about 3200 receive the town supply, and there are, moreover, 180 public fountains or stand-pipes. It is proposed to extend the gallery from 300 to 400 metres up the valley, as may be necessary to bring up the supply to the present required quantity of about 5¼ million gallons a day, and to protect the surface in the vicinity from any pollution for a considerable distance. The Municipality have recently bought springs in the mountains near Lucca, which are equal to the supply of about 13¼ million gallons per 24 hours at a high level. But these springs are 70 miles from Florence; and it will require three years at least to get the water into the town. Meanwhile, the gallery, when extended, will supply all that is required.

Accident on the Manchester Water-Works near Kendal.—Yesterday week a serious accident happened on the line of the Manchester Water-Works near Kendal. A gang of men were employed clearing away some earth, when one of them struck his pick into an unexploded cartridge. The result was that an explosion occurred; and two of the men were blinded and otherwise very severely injured.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

The illuminating power of the Edinburgh gas has been very much discussed within the last year or two; and appearances point to the likelihood of a continuation of the practice until something shall result from it. That something must be the only possible development out of the commercial situation in which the gas industry at present stands in Scotland in consequence of the high price of cannel; it can only be the lowering of the illuminating power of the gas, and an attendant reduction of price. There is no other escape from the present position of the Edinburgh and Leith Gas Commission. The charge of 4s. 6d. per 1000 cubic feet for gas of from 26 to 28 candle power is too high, in face of the competition from cheaper illuminants. The public will not stand it—that is, they do not care to pay the price, and would fain have it lowered. It is there, however, that the wrinkle comes in which disturbs the evenness of the public contemplation, for they would have the price reduced without any reduction in the lighting power of the gas. It takes a long time to convince the community that if they will have the one, they must have the other also. Even in high quarters, there is an ignorance of matters pertaining to gas supply which is positively disappointing. Take, for instance, the remark of Lord Provost Russell, of Edinburgh, at the meeting of the Town Council on Tuesday, that "he was sure there was not a place in Britain with a higher candle power" (than Edinburgh). Such a remark is arrant nonsense; and is particularly to be regretted in the mouth of the gentleman who is Chairman of the Edinburgh and Leith Gas Commission. Edinburgh is no better off in the matter of illuminating power than is Perth or Forfar, and until recently, Aberdeen; while it is positively lower than at some very much smaller places, such as Dunbar and Broughty Ferry. Ignorance upon such a simple matter of fact presupposes incapability to grasp the situation when more important issues are under consideration; and when a person in the position of the Lord Provost shows a primitive mind, what is to be expected of the general community? The subject came before the Town Council by a complaint made by Treasurer M'Crae to the effect that "the gas was very smoky," to which the Lord Provost replied that "gas of such power must be very smoky unless burned with very special burners." The Treasurer's retort was that it was "since the quality was reduced that the complaints had been made;" and then followed the Lord Provost's remark commented on above. Mr. Mackenzie suggested the lowering of the illuminating power of the gas with a view to escaping the people who made them pay a high price for coal, a sentiment which did not meet with the approval of Mr. Kinloch Anderson, the Convener of the Works Committee of the Gas Commission. Mr. Mitchell Thomson, who has retired from the Gas Commission, hoped it would not go abroad that it was the opinion of the Council that the quality of the gas should be reduced. There the matter ended. There was not much in the discussion; but it will help on the movement for cheaper gas.

The above remarks obtain point from what transpired at a meeting of the Edinburgh Merchants' Association on Wednesday. This is a body of commercial men who look at matters from a business point of view. Mr. Orrock, one of their number, told them that he had a gas-engine; and that to work it with gas at 4s. 6d. per 1000 cubic feet was a very costly affair indeed—in fact, it was a real tax upon industry. He advocated the reduction of the illuminating power. The speaker was generally supported by his brethren; and a Committee was appointed to consider the whole question and to report. This is an important step; and if the inquiry be gone intelligently about, it should help in the enlightenment of the people on a matter in which they require education. The Gas Commissioners generally will be glad to have any assistance in that direction. A year ago, it will be remembered, they endeavoured to lower the illuminating power; but in deference to clamour by West-end Edinburgh, they again raised it. The fallacy which then took hold of the public mind was that gas of low-candle power was less pure than that to which they had been accustomed. That has not yet been dispelled; and it lies with the Gas Commissioners to dispel it, by experiment or otherwise. There is a field in Edinburgh and Leith, in connection with the gas supply, for the making of a reputation, if the man were forthcoming who had a sufficient grip of the subject. Such trifling with it as was shown in the Town Council, illustrates how much such a man is wanted.

The Dundee Gas Commission at its monthly meeting on Wednesday, accepted offers for 8000 tons of coal to replace the 10,000 tons which was recently rejected on the advice of their analyst. Of this, 5000 tons are obtained from the Fife Coal Company at the price of 21s. per ton; and the remaining 3000 tons have been purchased at prices ranging downwards to 12s. 6d. per ton. In reply to a question, Mr. M'Crae, the Manager, stated that the 5000 tons were expected to produce gas of 31-candle power; and he thought the average would now be right. That is all very good; but why were the public not informed of the real state of matters? Do the Commissioners mean to take credit for supplying better gas than they have been doing without informing the public that they are making them pay for it? The average contract price as fixed last spring was 17s. 2½d. per ton; whereas the coal now contracted for is of an average price of not less than 17s. 10d. per ton, which should make a considerable difference on the resulting gas product. It is probable that the contractors who have been discarded would have supplied coal of the quality now contracted for, if they had been paid the price.

This has been a busy week in Inverness upon the subject of lighting. In the first place, the Sub-Committee of the Town Council which was appointed some time ago to consider the question of procuring water power for an electric light installation, issued their report; and in the second place, the Gas Committee of the Council met and considered the report of Mr. Thomson, the Gas Manager, upon the necessity for extending the gas-works. The Electric Lighting Committee's report should, if the public men of the place are wise, be the last of the proposal. Confining themselves to the question of procuring water power, they have ranged over the district, from the town supply to the Falls of Foyers, 18½ miles from Inverness, reporting upon no fewer than eleven sources of supply. One after another of these sources, they find to be unsuitable; and they settle down upon one which would involve the taking of water from the Caledonian Canal at its Inverness end about a mile from the town, for the driving of two turbines. The cost of the works they estimate at £7200; and if steam power were provided as an alternative in the event of a break-down of the water power, £3000 more would be required. This, it is to be observed, does not include the cost of conveying the electric current to the town, or its distribution. The Gas-Works Visiting Sub-Committee met on Wednesday to consider Mr. Thomson's report upon the proposal to expend about £10,000 upon the extension of the gas-works. Mr. Kenneth Fraser, the Convener, stated that the gas-works were barely able to supply the community with the present consumption of gas; and as this was increasing at the rate of half-a-million cubic feet a year, they would not be able to meet the demand next year. The gas-works were now being strained, which entailed great loss. For instance, retorts which should last two seasons, were being used up in two or three months; and the purifiers were being overworked. The extension proposed would, it was estimated, result in a saving of £7 per week. Provost Ross pointed out that the 400-horse power which it was proposed to apply to the production of electric light, would only give light equivalent to one year's increase of the gas consumption, and they would require to extend the gas-works irrespective of the introduction of electricity. The Sub-Committee unanimously recommended that the extensions should be proceeded with, and that to meet them £9000 should be borrowed. Next day, the Water and Gas Committee of the Town Council had this recommendation submitted to them; but they, in view of the electric lighting proposals, instead of adopting the Sub-Committee's recommendations, resolved to delay the matter and to ask Mr. Thomson to prepare a modified scheme Thus the gas supply of the town is being humbugged by an impossible electric lighting scheme. The time is short in which to proceed with the extensions at the gas-works; and one would think that even the most ordinary intelligence would see the advantage of expending £10,000 upon the perfecting of the gas supply, compared with the expenditure of probably £30,000 upon the introduction of an electric lighting installation, with the knowledge that they will also require to expend the £10,000 upon the gas-works.

At Thursday's monthly meeting of the Town Council of Glasgow, a discussion arose on the minutes of the Gas and Electric Lighting Committee, which was limited, however, to the item bearing upon the contract for the big gasholder which it has been resolved to erect at the Temple Farm gas-works. It may be remembered that I made mention, a couple of weeks since, of the contract having been placed with Messrs. R. Laidlaw and Son, of the Barrowfield Iron-Works, Glasgow. It was stated in the minutes that the amount of the accepted tender was £41,000; but it transpired in the course of the discussion that an offer to do the work for £1200 less had been received from Messrs. Hanna, Donald, and Wilson. The questions put by inquisitive members brought out the important fact that in the specification on which the tenders were based it was distinctly stated that early completion of the holder, as well as the price, would be taken into consideration in the placing of the contract. Now, it so happens that the Glasgow firm offered to give delivery in July, 1893; whereas October was mentioned by the Paisley firm. Of course, the prospect of getting delivery of the holder three months earlier in the one case than in the other, naturally had some influence with the Sub-Committee on Contracts in causing them to come to the decision they did. But the fact, or alleged fact, that the Council were throwing away £1200, if the minutes were adopted, did not fail to raise objections; and one member actually went the length of entering his dissent, which was duly recorded. He went on the principle, he said, that, all things being equal, the lowest offer should be accepted. Another strict municipal moralist was concerned to know if everything had been done fairly and above-board when the matter was before the Contract Committee, and if every firm that sent in a tender was treated on the same footing. He was assured by a member of the Committee that such was the case. With the one instance of dissent referred to, the minutes were adopted.

There was also a minute in reference to the acquisition of the electric lighting stations, machinery, business, &c., of Messrs. Muir, Mavor, and Coulson by the Corporation, at the price of £15,000. It seemed, however, that the minute, as to the terms of the agreement, had still to be revised; and consequently the Committee were authorized to take it back. I may say, however, that the bargain between the buyers and sellers has been practically concluded; and that the officials of the Gas and Electric Lighting Committee are preparing to take over the two generating stations, &c., which have enabled Messrs. Muir, Mavor, and Coulson to supply the electric light in the central area of the city. It has been practically concluded that on and after March 1 next, what was the Glasgow Gas Trust pure and simple, will be engaged in supplying electricity for lighting purposes as well as coal gas. It will be many months before the Corporation Electric lighting station, fully half a mile to the west, and which is being designed by Professor A. W. W. Kennedy, will be ready to supply current to the west central area and the West-end proper. Indeed, it is scarcely probable that the new station will be in working order by August, when the two years allowed for active operations by the Electric Lighting Provisional Order will have expired.

While dealing with electric lighting matters, I may state that a letter has been received by the Electric Lighting Sub-Committee from the Board of Trade, intimating that, in the event of the Corporation acquiring the undertaking of Messrs. Muir, Mavor, and Coulson, and provided that the Board are satisfied as to the safety of the system in other respects, they will not object to the temporary use of the existing overhead wires, pending the completion of the installation about to be acquired by the Corporation.

This week's Glasgow pig-iron market has been quiet, in consequence of the occurrence of the holidays. The ironmasters' returns for the past year, which were published on Tuesday, were regarded by the trade as being very unsatisfactory, as they showed a reduction for the year, on home consumption and exports, of fully 500,000 tons. Prices remain but very slightly changed. Scotch is still quoted at 47s. per ton cash—the Syndicate's price. Carron No. 1 has come down 6d. per ton, to 56s. 6d.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan.* 9.

Sulphate of Ammonia.—The complete metamorphosis of the market, although it was to a great extent unforeseen at this early period of the season, cannot altogether come as a surprise. It has been pointed out over and over again in these columns, and it has been shown by the stubborn facts of undeniable figures, that sulphate was much too low down in the scale of values, and that whichever way the position was viewed, only by a complete error of judgment could consumers refrain from buying sulphate, it being the cheapest source of ammonia. Still this does not account for the extremely sudden change; for, at the present moment, dealers, speculators, and consumers vie with each other to secure everything available. Is it then correct to assume that it required but a key-note to start the thing into life? It has been given; and mark the change! What is happening now is that dealers and speculators are scrambling for January contracts, to cover previous sales; while consumers, though annoyed at having been misled, and having missed so many favourable opportunities, still are making hot haste to repair the mischief. No wonder, therefore, that there is an advance of about 5s. per ton on the week; and though some consider that the market is moving a little too rapidly, others think it is not so when delayed requirements and short sales are taken into account. The movement in the spot market is bringing with it a considerable inquiry for futures; and 10s. to 15s. per ton advance on the lowest December quotations is reported as having been paid for spring delivery and delivery up to June next. Nitrate has improved, and 9s. 4½d. to 9s. 6d. has been paid for cargoes, while spot price is now 9s. 4½d. per cwt.

LONDON, *Jan.* 9.

Tar Products.—This market continues as flat and uninteresting as it can possibly be; and there are no buyers of anything excepting pitch—the result being that all products, with the exception named, are decreasing in value. It is beginning to have its effect on tar, as an important contract was booked during the week of a very good quality at 19s. 6d. per ton. Curiously, pitch continues fairly strong; large shipments are taking place, and one or two important contracts forward are reported at a shade below to-day's quotation. Nominal quotations are: Tar, 19s. 6d. Pitch, 34s. Benzol, 90s., 1s. 11d. to 2s. 1d.; 50's., 1s. 7d. to 1s. 7½d. Toluol, 1s. 2d. Solvent naphtha, 1s. 1d. Naphtha, 30 per cent., 11d. Creosote, ¾d. to 1d. Crude carbolic, 60's., 1s. 1d.; crystals, 5d. Cresol, 8d. Anthracene, "A" quality, 1s. to 1s. 1d.; "B," 8d. to 9½d.

Sulphate of Ammonia.—There seems to be more activity in this market; and important sales are reported at prices ranging from £10 7s. 6d. to £10 12s. 6d., less 3½ per cent. There is a good deal of inquiry; and the price is likely to improve. Gas liquor (10-oz.) is quoted at 6s. to 7s. 6d. per ton, according to position.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Except that the ordinary course of business has been recently considerably disorganized by the usual holiday stoppages of collieries and works throughout this district, there is no material change to notice in the condition of the coal trade here. House-fire qualities are in fairly good demand at late rates—best Wigan Arley averaging 12s. 6d.; Pemberton 4-feet, and second qualities of Arley, 10s. 6d. to 11s.; and common house-fire coals, 9s. to 10s. per ton. With regard to the lower qualities of round coal, the stoppage of works has to some extent counterbalanced the cessation of the output at the collieries; and there has been no scarcity of supplies, while prices still show a weakening tendency. For inland requirements, 8s. to 8s. 6d. remain the average quotations at the pit mouth; but for shipment buyers are holding out for lower figures, and there has been very little business doing, with Lancashire steam coal not averaging more than 9s. 6d. to 10s. per ton delivered at the ports on the Mersey. Engine classes of fuel have been in generally brisk demand, as with few exceptions mills have only very limited accommodation for stocking purposes; and all descriptions of slack have been moving freely away, with prices showing more firmness than recently, although there is no really quoted advance upon late rates. At the pit mouth ordinary classes of burgy do not average more than 6s. to 6s. 6d.; best qualities of slack, 5s. to 5s. 6d.; good ordinary descriptions, 4s. to 4s. 6d.; and common sorts, 3s. to 3s. 6d. per ton at the pit—these figures representing the maximum prices obtainable.

Northern Coal Trade.—There is considerable activity in the northern coal trade after the holidays; and as stocks of some kinds of coal had been considerably reduced, there was a full demand experienced. Best Northumberland gas coals vary in price from 10s. to 10s. 6d. per ton, free on board; and most of the collieries have very fair orders on their books. Second-class coals are weaker in position; the price varying from 9s. to 9s. 9d. per ton, free on board. Small steam coals are plentiful, at prices averaging about 4s. 3d. per ton. For gas coals, the demand is still extremely heavy; and as the work was not at its fullest for the first fortnight after the holidays, stocks have needed to be replenished. The price varies; but from 9s. to 9s. 6d. per ton, free on board, may be taken as the general average figures. In coke, best blast-furnace qualities are firm; and 16s. per ton, free on board, is the general rate. Gas coke seems more difficult of sale just now; and contracts are believed to have been placed at lower prices than have of late been quoted—about 9s. per ton having been rumoured as the price for a recent contract.

The Storeage Capacity at the Ripon Gas-Works.—The question of the necessity of increased storeage for gas at the Ripon Corporation Gas-Works was brought before the Gas Committee last Thursday night by the Manager (Mr. F. Shepherd). It appears that during the month of December the total manufacture of gas was 4,161,000 cubic feet; and on Christmas Eve, the amount of gas in the holders was reduced 4000 feet—the retorts at the same time being charged to their full capacity. It was decided to specially bring the subject of an enlarged storeage capacity before the Council.

The Proposed Purchase of the Bideford Gas-Works by the Corporation.—The Bideford Town Council last Thursday had a further discussion on the question of acquiring the gas-works; and in the end they passed the following resolution: "That, subject to all necessary consents being obtained thereto and to the sanction of the Local Government Board, the Gas Company be informed that the Town Council are desirous of negotiating with them for the purchase of their undertaking upon the basis of clause 2 of the Electric Lighting Act of 1882; but before committing themselves to this, they desire to consult the ratepayers of the borough on the subject, and will take an early opportunity of doing so. And, further, that the Secretary of the Company be requested to submit to the Directors for consideration the question of suspending, until the session of 1893, their application for the Provisional Order, so that negotiations may be proceeded with."

Birmingham Corporation Water Scheme.—At the next meeting of the Severn Fishery Board, the Chairman (Mr. J. W. Willis Bund) will submit for consideration a letter on the subject of Water Bills, which he has addressed to the Chief Inspector of Fisheries. In his communication, Mr. Bund states that the Severn Fishery Board have come to the conclusion that the time has arrived for the Board of Trade or some Government Department or for Parliament by Standing Order to lay down some general rules that should apply in all cases, defining the terms and conditions under which an outside authority is to be entitled to abstract water from a watershed. The Liverpool Act of 1880, which will doubtless be referred to as the great precedent for the Birmingham scheme, to some extent recognized the rights of towns and persons affected in the elaborate provisions made in it for compensation water. But those provisions were (he points out) obtained at the instance of individual bodies; and it is most desirable that matters of such national importance should not be left to individual action.

Distribution of Gifts at the York Gas-Works.—It will be remembered that, owing to the great pressure put upon the York Gas Company by the extremely cold and foggy weather of Christmas week, all the workmen could not be present when Mr. C. Sellers, the Company's Secretary and Manager, gave his usual address, reproduced in the JOURNAL for the 29th ult.; and, in consequence of this, the distribution of the Christmas gifts for their children was postponed until the 2nd inst. On the assembling of the men, Mr. Sellers briefly congratulated them upon the brave and loyal manner in which they had worked shoulder to shoulder to meet the unprecedented strain put upon the Company by the extraordinary weather; and expressed his especial pleasure in the fact that they had had only one fool in the entire staff who had, during the Christmas week, tarnished their reputation and disgraced himself by drinking. The distribution of articles of dress, books, and toys then took place; and after the men had thanked the Directors of the Company, who contributed to the gift fund, and also Mr. Sellers, they heartily joined in recognizing this gentleman's mother in musical cheers, and then went to their respective homes.

The Gas Supply of Hornsey.—At the meeting of the Hornsey Local Board on Monday last week, the Surveyor (Mr. T. De Courcy Meade) brought up a report on the question of the gas supply of the district. He stated that he had received a notice from The Gaslight and Coke Company to the effect that the price of gas supplied by meter would be increased from 2s. 9d. to 3s. 1d. per 1000 cubic feet after the Christmas quarter. He wrote to the General Manager of the Company (Mr. J. Orwell Phillips), asking if the increase applied in any way to the gas supplied to the public lamps, and had received a reply in the negative. The Manager of the Hornsey Gas Company had written stating that, notwithstanding the large sum which had been expended on the extension of the works (much of which must remain unproductive for some years), and that the cost of coal and labour had largely increased, he hoped his Directors would be able to continue to sell gas at the present price, and that, with this object in view, they had not paid the 1¼ per cent. additional dividend which they were entitled to do under the sliding scale. He also added that contracts had recently been let for further extensions, amounting to £10,000, and that they were now contemplating expending about £26,000 for the same purpose during the present year. Colonel Bird remarked that the quantity of gas supplied by the latter Company was not sufficient, and recently the district was in darkness. Many complaints had been received in regard to it; and the tradesmen of Crouch End were preparing a petition on the subject to present to the Board. The report was ordered to be entered on the minutes; and the subject dropped.

The New Public Health Act for London and the Smoke Nuisance.—At the meeting of the Balloon Society on the 1st inst., Mr. H. G. Assiter, President of the Association of Sanitary Inspectors, read a paper on "The Public Health (London) Act, 1891," which came into operation on that day, in the course of which he dealt with the clauses relating to smoke consumption. He said that the chief alteration had been to remove the duty of executing the law on the subject from the shoulders of the police, and to place it on the sanitary authority. Every chimney whatsoever, except those of private dwelling-houses, was now subject to the provisions of the Act. With this slight strengthening of the law, and the duty of the sanitary authority to execute it being made imperative, we might hope to benefit by the change. The lecturer expressed the opinion that there is no excuse, seeing the many excellent inventions for ensuring the consumption of smoke, for anyone who breaks this law. Mr. Assiter said it was to be regretted that some legislation was not effected with regard to the chimneys of private houses, which were very great offenders. He was in a position to say that it would not be a difficult matter to consume the smoke arising from domestic fireplaces; and he hoped in a few years to see the law amended in this respect, when he predicted that we should have less of the dreadful fogs which afflict people at this season, although we might never hope to entirely get rid of them. At the close of the paper, a resolution was passed expressing the hope that the smoke abatement clauses would be thoroughly carried out, and in future be extended to the chimneys of all domestic fireplaces. A vote of thanks was accorded to Mr. Assiter.

The Managership of the Colne Gas-Works.—At the last meeting of the Colne Local Board, Mr. G. Dyson, a member of the Board, was appointed Manager of the gas-works. It was stated that Mr. Dyson (who had resigned his seat on the Board) was conversant with everything connected with the department; and his selection would be of advantage to the ratepayers.

The Proposed Acquisition of the Belper Water-Works by the Local Board.—Within the past few days the result has been made known of the poll taken in Belper to decide whether the Local Board should be requested to purchase the property and plant of the local Water Company. The Company recently agreed to borrow a sum of £4000 to improve the supply of water and for the extension of mains. This course was opposed by many ratepayers, and a public meeting was held, at which it was decided to ask the Local Board to buy up the Company. The authority, however, preferred to have an expression of opinion from the ratepayers. Voting papers were distributed throughout the district; and the result of the poll is as follows: For the purchase, 463; against, 868; neutral, 222, The Local Board will not, therefore, entertain the proposal.

Improvement in the Water Supply Works at Harrogate.—The Harrogate Water Company have recently made some important alterations and improvements with respect to their supply; and they are extending the storeage capacity from 60 millions to 160 million gallons. The water is taken from Haverah Park, situated about four miles from Harrogate in a westerly direction. At that place there are two large reservoirs, one of which is 615 feet above sea level.. The water gravitates to storeage reservoirs near Harrogate, where the filtration is carried out. The storeage accommodation is sufficient for a full supply for upwards of eight months without rain. Some necessary alterations have been carried out at the two reservoirs at Haverah Park; and valve-towers are now being constructed for regulating the supply from the reservoirs. The Beaver Dyke reservoir is in course of enlargement; and this is being effected by raising the embankment across the valley by 15 feet. A new overflow weir bridge and bye-wash are also being built. The present gathering-ground is more than 700 acres in extent, and includes the land below the Fewston reservoirs, which are situated scarcely three miles away, and form part of the Leeds water supply. Mr. Dixon, the Company's Engineer, has superintended the whole of the alterations.

Gas Affairs at Rotherham.—The Rotherham Town Council, last Wednesday, resolved, on the recommendation of the Gas Committee, to extend the storeage accommodation at the gas-works by adding a third lift to one of the holders, and to purchase a new station meter and a washer-scrubber. At the same meeting, Mr. Gummer moved—"That a gas engineer be appointed to manage the gas and water works undertakings, at a salary of £300 per annum." He remarked that it seemed to him that now the time had arrived when they should appoint a Gas Engineer. He denied that any injustice was intended towards an old servant; but they wished to have a more scientific and educated engineer, who could exercise supervision over the works, and the costly extensions being carried out. There was a vacancy in the management of the water-works, and he was in favour of the appointment of an engineer to manage both concerns. Mr. Charles seconded the motion. Mr. Cox declined to support it, and spoke highly of the management of the gas-works by Mr. Goodwin, pointing out that the gross profits had been 14½ per cent., and the net profit 8½ per cent. over a period of ten years. In regard to the gas-works, Rotherham had done as well as any town in England; and the results had reflected the highest credit on the Manager. The resolution was carried by eleven votes to ten.

Rochdale Corporation Gas-Works.—At the monthly meeting of the Rochdale Town Council last Thursday, the Mayor (Alderman W. J. Petrie), the Chairman of the Gas Committee, informed the Council that the Committee had been experimenting with two things new to the gas managers of this country—the use of inclined retorts, and of oxygen for purification purposes. They had found that the use of the inclined retorts saved time in charging and drawing; and therefore there was a considerable saving in the expense of labour. There were some little drawbacks, such as an unequal heating of the retorts; but as they now had had practical experience of them, they would be able to weigh the advantages against the drawbacks when the time came to replace the existing retorts. They had been using oxygen in the purifying operations; but it did not raise the illuminating power of the gas, as they had expected it would. He also mentioned that the Committee had been able to purchase, at a reasonable price, a plot of land near the gas-works on which to erect large gasholders; and they had sketched out a plan for utilizing their own ground more economically. They also intended to enlarge the mains in the principal streets The total cost of the extensions and alterations would amount to £60,000; and if they used inclined retorts, this would cost an additional £6000.

Serious Fire at a Compressed Fuel Factory.—Last Thursday, a fire broke out at the perforated block fuel factory of Messrs. Forbes, Abbott, and Lennard, on the banks of the Thames at Greenwich, and developed into a conflagration which was not extinguished until late in the evening. It originated in a building 80 feet long and 70 feet wide, utilized in the manufacture of the blocks; and at the time of the outbreak it contained several hundred tons of very small coal. The place was used, in fact, as a coal bunker; and it lead into a corrugated iron building, measuring 100 feet long by 90 feet wide, and about 50 feet high, employed as a manufactory and store. This was filled with materials of a most inflammable character, and was surrounded, in the large yard attached to the premises, by tar pits and casks containing large quantities of combustible material. Work was proceeding in the usual course when the alarm was raised that the big coal bunker was on fire; and directly afterwards great clouds of smoke, followed by enormous tongues of flame, were seen issuing from the extensive building nearest to the river. The workmen at once began to attach a hose to two private hydrants which were fitted on an adjoining building, and started pumping water on the flames. Soon the Fire Brigade arrived; and they worked with tremendous energy. The result of their labours, which were carried on under great difficulty, owing to the risk run by the men of falling into the river, was that the fire was effectually quelled, and the adjacent property saved from destruction.

Projected Extension of Gas Lighting in Turkey.—M. Charles Georgi, concessionaire of the gas lighting of Kadikeui and the villages on the Asiatic coast of the Bosphorus, has applied to the Government for the concession for 60 years for the gas or electric lighting of Pera, a suburb of Constantinople, and Beshiktash. In his application, M. Georgi engages, says the *Financial News*, to construct, at a cost of £T8000, gas-works capable of producing 1½ million cubic feet of gas in 24 hours. He agrees, moreover, to supply gas free of charge to the mosques and barracks of Beshiktash, to grant a reduction of 30 per cent. on the usual charge to the medressehs, hospitals, patriarchates, churches, and public establishments and benevolent institutions, to increase the number of gas-burners in the streets to 1500, and to pay a royalty to the Government equal to 15 per cent on the net receipts of the Company.

City of Norwich Water-Works Company.—The half-yearly general meeting of this Company was held on the 23rd ult.—Mr. H. S. Patteson in the chair. The Secretary (Mr. R. Cooper) read the balance-sheets of receipts and expenditure of capital and revenue of the Company to Sept. 29 last, which were submitted for the inspection of the shareholders; and he subsequently read the Directors' report. It was stated therein that, after payment of the working expenses, debenture interest, and preferential dividend, and including the balance carried over from the previous half year, there remained a sum sufficient to pay a dividend on the ordinary shares at the rate of 6 per cent. per annum, deducting income-tax; leaving a balance of £736 to the credit of the next half-year's account. The Directors therefore declared a dividend at this rate. The Chairman moved the adoption of the report; and the motion was carried unanimously. He also read a long statement as to the recent offer made, on behalf of the Corporation of Norwich, to purchase the Company's undertaking; and explained the views of the Directors thereon. (It may be remembered that the price offered was 10 per cent. premium upon the market value of the shares; and as the Directors declined to lay this before the proprietors, the project fell through.) The business of the meeting having terminated, a resolution was passed expressing the shareholders' confidence in the Chairman and Directors, as well as the Manager of the Company (Mr. J. Ayris, M. Inst. C. E.), and thanking them for the prudence and forethought they have exercised in the interests of the Company.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 62.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	10	16–17	+½	6 3 6
100,000	10	,,	7½	Do. 7 p. c.	10	11¼–12½	+¼	6 0 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105–107*	..	4 13 6
100,000	20	27 Nov.	8	Bahia, Limited	20	12–14	..	11 8 6
200,000	5	12 Nov.	7½	Bombay, Limited	5	6¾–7	+¼	5 7 1
40,000	5	,,	7½	Do. New	4	4¾–5¼	+¼	5 14 1
380,000	Stck.	13 Aug.	12½	Brentford Consolidated	100	210–220	..	5 11 4
125,000	,,	,,	9½	Do. New	100	157–162	..	5 14 2
220,000	20	16 Sept	11½	Brighton & Hove Original	20	40–42	..	5 9 6
888,500	Stck.	16 Sept.	5	Bristol	100	98–103	..	4 17 1
320,000	20	15 Oct.	11½	British	20	42–44	..	5 8 3
50,000	10	28 Aug.	11½	Bromley, Ordinary 10 p. c.	10	18–20	..	5 15 0
50,380	10	,,	8½	Do. 7 p. c.	10	13–15	..	5 13 4
328,750	10	—	—	Buenos Ayres (New) Limited	10	5¾–6¼	..	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	90–95*	..	6 6 4
150,000	20	13 Aug.	8	Cagliari, Limited	20	24–26	..	6 3 1
550,000	Stck.	15 Oct.	13½	Commercial, Old Stock	100	240–250	..	5 10 0
165,000	,,	,,	10½	Do. New do.	100	185–195	..	5 10 3
130,000	,,	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	117–122*	..	3 13 9
800,000	Stck.	30 Dec.	13	Continental Union, Limited	100	220–230*	+5	5 13 0
200,000	,,	,,	10	Do. 7 p. c. Pref	100	185–195*	..	5 2 7
75,000	Stck.	16 Sept.	10	Crystal Palace District	100	190–200	..	5 0 0
486,090	10	15 July	10	European, Limited	10	19–20	..	5 0 0
354,060	10	,,	10	Do. Partly paid	7½	14–15	..	5 0 0
5,470,640	Stck.	13 Aug.	13	Gaslight & Coke, A, Ordinary	100	223–227	+1½	5 14 6
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	94–97	..	4 2 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	248–253	..	3 19 1
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	118–123	..	4 1 4
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	172–177	..	4 4 9
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	153–158	..	4 8 7
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	245–250	..	4 0 0
476,000	,,	,,	—	Do. K, 6 p. c. Prf.	100	145–150	..	4 0 0
1,061,150	,,	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	110–114	..	3 10 2
294,850	,,	,,	4½	Do. 4½ p. c. dc.	100	118–123	..	3 13 2
908,000	,,	,,	6	Do. 6 p. c. do	100	160–165	..	3 12 9
3,800,000	Stck.	12 Nov.	12	Imperial Continental	100	221–226	+2	5 6 2
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4–4¼	..	6 13 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	109–117	..	4 10 1
541,920	20	27 Nov.	6½	Monte Video, Limited	20	15–16	..	8 2 6
150,000	5	27 Nov.	10	Oriental, Limited	5	8½–9	..	5 11 1
60,000	5	30 Sept.	7	Ottoman, Limited	5	4–5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2¾–3¼	..	—
420,000	100	3 Nov.	6	People's Gas of Chicago— 1st Mtg. Bds.	100	94–99	..	6 1 3
500,000	100	1 Dec.	6	2nd Do.	100	93–98	..	6 2 5
150,000	10	15 Oct.	10	San Paulo, Limited	10	11–12	..	8 6 8
500,000	Stck.	28 Aug.	15½	South Metropolitan, A Stock	100	265–275	..	5 12 9
1,350,000	,,	,,	12	Do. B do.	100	222–227	+2	5 5 8
200,000	,,	,,	13	Do. C do.	100	225–235	..	5 10 8
700,000	,,	30 Dec.	5	Do. 5 p. c. Deb. Stk.	100	138–143*	..	3 10 0
602,000	Stck.	16 Sept.	11½	Tottenham & Edm'nton, Orig.	100	—	..	—
				WATER COMPANIES.				
729,331	Stck.	30 Dec.	10	Chelsea, Ordinary	100	255–265*	..	3 15 6
1,720,560	Stck.	15 Oct.	8	East London, Ordinary	100	204–209	+1	3 16 7
544,440	,,	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	136–140*	..	3 4 3
700,000	50	11 Dec.	8	Grand Junction	50	98–103	..	3 17 8
708,000	Stck.	13 Aug	10½	Kent	100	270–275	+2½	3 16 4
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	220–230*	..	4 2 7
406,200	100	,,	7½	Do. 7½ p. c. max.	100	189–194*	..	3 17 4
260,000	Stck.	30 Sept.	4	Do. 4 p. c. Deb. Stk.	100	120–123	..	3 5 0
500,000	100	13 Aug.	12½	New River, New Shares	100	335–345	..	3 10 4
1,000,000	Stck.	30 July	4	Do. 4 p. c. Deb. Stk	100	125–127	..	3 3 0
902,300	Stck.	30 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	150–153*	+3	4 4 11
126,500	100	,,	6½	Do. D 7½ p. c. do.	100	140–145*	+2	4 9 8
1,155,066	Stck.	11 Dec.	10	West Middlesex	100	245–255	..	3 18 5

*Ex div.

Fatal Explosion at the Windsor Street Gas-Works at Birmingham.—An explosion involving fatal injuries to a stoker named James Merrill (aged 56), occurred about midnight on Thursday at the Windsor Street Gas-Works of the Birmingham Corporation. Merrill, after ceasing work at twelve, joined a number of fellow-workmen in the mess-room. The apartment is provided with a cooking-range; and the man had an idea that the fire did not draw as well as it might, owing to the choking of the flue. With the view of remedying the defect, he took a can of naphtha, and poured it down one of the flues; evidently thinking that the blaze would ascend in sufficient force to remove any obstacle. An explosion of an alarming character immediately followed this act. The kitchen was in a moment filled with smoke and dust, and the men made their escape with all promptitude. Merrill, however, appears to have been overcome by the fumes; and his comrades, on discovering that he had failed to escape, returned to his rescue. The poor fellow was then enveloped in flames. The fire having been extinguished, oil and wool were applied to the injured man with all haste prior to his removal to the General Hospital. He was so terribly burnt that he succumbed during Friday afternoon.

Bilston Gas Company.—The annual meeting of this Company was held yesterday week. The Secretary (Mr. J. S. Reeves) read the notice convening the meeting; and then the Chairman (Mr. T. Holcroft, J.P.) moved the adoption of the report and statement of accounts, which were summarized in the JOURNAL for Dec. 29. He first referred to the point mentioned in the report, that the profits of the year had not been sufficient to pay the usual dividends, but the difference (£450) had been taken from the unappropriated profits of previous years. He considered that, as the past year had borne the full brunt of the higher prices of coal, the results might be deemed very satisfactory. Owing mainly to the severe weather of last winter, there had been an increase in the sale of gas of about 6¼ per cent. He, however, did not expect much increase in the consumption during the current year. With a view to the greater economy in the manufacture of gas, he said, they had spent a considerable sum in improving their carbonizing plant; but as the benefits of these improvements would extend over a number of years, they had charged the cost to a "suspense account," which it was proposed to wipe off gradually. With regard to the reference in the report to the proposed amalgamation of the Willenhall Gas Company with their own Company, the principal advantages of such an amalgamation would have been to the consumers of gas, particularly those in Willenhall, who would immediately have benefited by a reduction of 3d. per 1000 cubic feet. As, however, the local authorities of both Willenhall and Bilston were opposed to any such amalgamation, and had resolved to carry their opposition to the Board of Trade, the Directors of the Bilston Company decided not to proceed further with the application. The report was adopted; and the usual dividends of 10 per cent. and 7 per cent. on the "A" and "B" shares respectively were declared.

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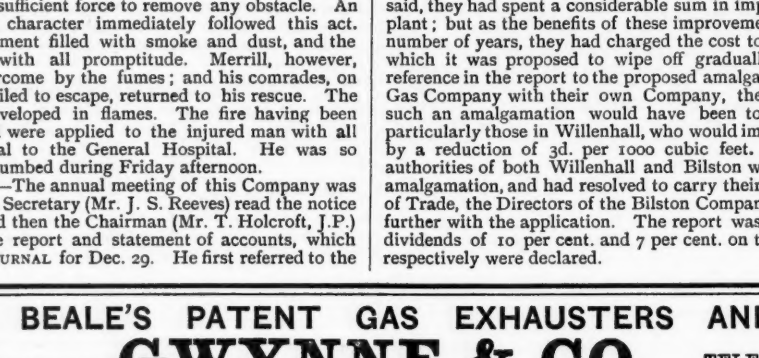

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COZE'S Automatic Apparatus for CHARGING AND DISCHARGING GAS-RETORTS. For Illustrated Advertisement of this System, see p. 86.
Inquiries should be addressed to THE AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED, 86-88A, LEADENHALL STREET, E.C.

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WANTED, a good steady man as STOKER, not over 32 years of age. Must be used to charging with shovel, and thoroughly understand a steam-engine and exhauster, and one who can make himself generally useful. Wages, 27s. per week.
Apply, at once, with character, stating age, experience, whether married or single, and when candidate would be prepared to enter on his duties, to W. C. DAWSON Gas-Works ARUNDEL.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

WANTED, by a young Man (Married), a situation as GAS-FITTER. Well up in Compo. and Iron; also in fixing Meters and Cooking-Stoves, and Main and Service laying.
Apply, by letter, to No. 2055, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

AGENT wanted, already in relation with Gas Engineers all over England, to SELL, on Commission, a SPECIAL ARTICLE to Gas-Works. A Gas Engineer preferred.
Address, with references, F. W., Rue Juste Lipse, 22, Brussels, BELGIUM.

WANTED, by the 30th of January, a steady and experienced STOKER.
Apply to the SECRETARY, Gas Company, Knighton, RADNORSHIRE.

WANTED, a young Man to assist in Stoking in a small Gas-Works. Wages £1 per week.
Apply, by letter, with references, to No. 2053, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a thoroughly competent Yard and Retort-House FOREMAN in a Provincial Gas-Works. Make 150 Million cubic feet per Annum. Wages two Guineas per week. Constant employment to a good and steady Man.
Apply, by letter, to No. 2052, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, an experienced Carbonizing Foreman for London Gas-Works. Liberal wages will be given to anyone possessed of the proper qualifications. Applicants must be under 40 years of age. One having general experience of Gas Manufacture preferred.
Apply, by letter, with not more than two testimonials, to No. 2056, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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WANTED, a Working Manager for a small Gas-Works, making about a million cubic feet per annum. Must be able to take entire charge, and do all Stoking, Main and Service laying, Lamp-lighting (16 lamps), Meter inspecting and fixing (40 Meters), &c.; and sell Coal, Coke, Tar, &c., at the Works.
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Applications, stating age, qualifications, and previous employment, with not more than three testimonials of recent date, to be sent to me not later than the 26th of January, 1892.

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THE Gas Committee invite Tenders for the supply and erection of an ANNULAR CONDENSER complete, with 14-inch Connections and Bye-Pass Valves, capable of passing 80,000 cubic feet per hour.
Tenders, with tracing enclosed, showing the general arrangement of the Condenser, to be sent to me on or before the 21st day of January.

HY. SIMMONDS,
Engineer and Manager.
Gas-Works, Colne,
Jan. 8, 1892.

SCRUBBER for Sale, in good condition. To be removed on account of extensions.
Particulars on application to No. 2058, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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PURIFIERS AND STATION METER FOR SALE.

THE Corporation of Chorley are pre- pared to receive TENDERS for the purchase of four 10 feet square PURIFIERS, with Hydraulic Centre-Valve and Meter, 10-inch Connections complete, and in good working condition, at the Chorley Gas-Works, but recently thrown out of action in consequence of extensions.
The purchaser will be required to take down and remove the above at his own expense.
Further particulars may be obtained on application to Mr. Blackledge, Gas Manager, Chorley.
Tenders, endorsed "Purifiers," may be sent to me before Noon on Wednesday, the 20th of January, 1892.

By order,
THOS. A. JACKSON,
Town Clerk.
Town Hall, Chorley.

BOROUGH OF CHORLEY.

TO GAS ENGINEERS AND OTHERS.

THE Chorley Corporation invite Tenders for the supply and fixing of the following at their Gas-Works, Water Street, Chorley, viz.—
1. One ROTARY GAS EXHAUSTER (Single) complete, to pass 40,000 cubic feet of gas per hour.
2. One complete set of ANNULAR CONDENSERS, suitable for a make of Gas after the rate of a million cubic feet in 24 hours.

Further information can be obtained from Mr. Wm. Blackledge, Gas Manager, Chorley.
The Corporation do not bind themselves to accept the lowest or any tender.
Tenders, endorsed "Exhauster" or "Condensers" as the case may be, to be sent to me before Noon, on Wednesday, the 20th of January, 1892.

By order,
THOS. A. JACKSON,
Town Clerk.
Town Hall, Chorley.

CIRENCESTER GAS COMPANY, LIMITED.

SALE OF 300 SHARES.

THE Directors of the Cirencester Gas Company, Limited, give notice that 300 £15 NEW ORDINARY SHARES, bearing a maximum Dividend of 7 per cent., of and in the Cirencester Gas Company, Limited, being a portion of the additional Capital authorized to be raised under the provisions of the Cirencester Gas Order, 1891, will be offered FOR SALE by auction by Messrs. Moore and Hill, at the King's Head Hotel, Cirencester, on Monday, the 18th day of January, 1892, at Four o'clock in the afternoon precisely, in lots of Five each, and will be issued to each purchaser as paid-up Shares after full payment of the purchase-money.
Further particulars and Conditions of Sale may be obtained from the Auctioneers, Corn Hall Buildings, Cirencester; Messrs. Mullings, Ellett, and Co., Solicitors, Cirencester; or of

J. P. BERCHAM,
Secretary.
12, Silver Street, Cirencester,
Dec. 23, 1891.

THE Gas Committee of the Corporation of Heywood are prepared to receive TENDERS for the supply of RETORTS and FIRE-BRICKS.
Tenders, endorsed "Retorts and Fire-Bricks," must be delivered to me not later than Tuesday, the 19th day of January, 1892.
Specification, Quantities, and Form of Tender may be obtained upon application to the Manager, Mr. W. Whatmough.
The Committee do not bind themselves to accept the lowest or any tender.

By order,
ALFRED WALLIS,
Town Clerk.
Municipal Buildings,
Heywood, Jan. 1, 1892.

BOROUGH OF WEST BROMWICH.
(GAS DEPARTMENT.)

THE Gas Committee are prepared to receive TENDERS for the construction of a BRICK GASHOLDER TANK, 134 feet diameter, at their Gas-Works, Albion, West Bromwich.
Drawings and Specifications may be seen, and all information obtained, upon application to the Manager (Mr. Littlewood), at the Works, as above.
Tenders, properly endorsed, to be sent to me at the Town Hall, West Bromwich, not later than the 28th inst.
The Gas Committee do not bind themselves to accept the lowest or any tender.

By order,
THOS. HUDSON,
Secretary.
Town Hall, West Bromwich.
Jan. 9, 1892.

SHEFFIELD UNITED GASLIGHT COMPANY.

GRIMESTHORPE STATION.
CONTRACT No. 4.
TO IRONFOUNDERS.

THE Directors of this Company invite TENDERS for the supply of CAST-IRON STANDARDS and other IRONWORK required for a Framing in the No. 1 Gasholder Tank at their Grimesthorpe Station.
Bill of Quantities may be obtained, and the Drawings may be seen at the Company's Offices upon application to the Engineer, Mr. Fletcher W. Stevenson.
The Directors do not bind themselves to accept the lowest or any tender.
Sealed tenders, marked "Tender for Ironwork for Tank Framing," and addressed to the undersigned, must be delivered at the Company's Offices, by post, not later than Saturday, Jan. 30, 1892.

HANBURY THOMAS,
General Manager.
Commercial Street, Sheffield,
Jan. 9, 1892.

SHEFFIELD UNITED GASLIGHT COMPANY.

GRIMESTHORPE STATION.
CONTRACT No. 5.
TO JOINERS AND GENERAL BUILDERS.

THE Directors of this Company invite TENDERS for the construction of a TIMBER FRAMING in the No. 1 Gasholder Tank, at their Grimesthorpe Station.
Bill of quantities may be obtained, and the Drawings may be seen, at the Company's Offices, upon application to the Engineer, Mr. Fletcher W. Stevenson.
The Directors do not bind themselves to accept the lowest or any tender.
Sealed Tenders, marked "Tender for Timber Framing for Gasholder Tank," and addressed to the undersigned, must be delivered at the Company's Offices, by post, not later than Saturday, Jan. 30, 1892.

HANBURY THOMAS,
General Manager.
Commercial Street, Sheffield,
Jan. 9, 1892.

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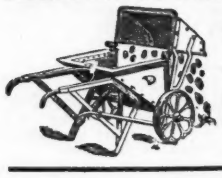

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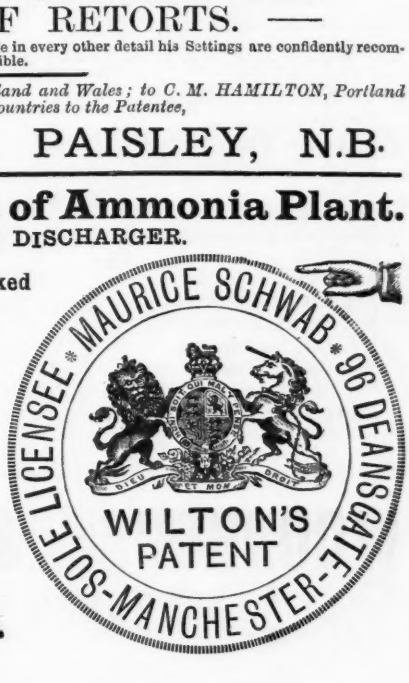

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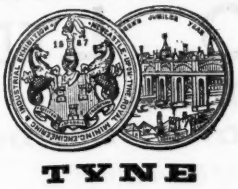

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Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

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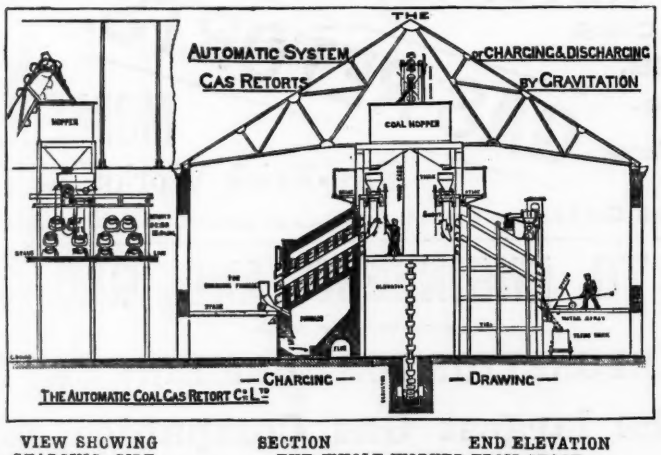

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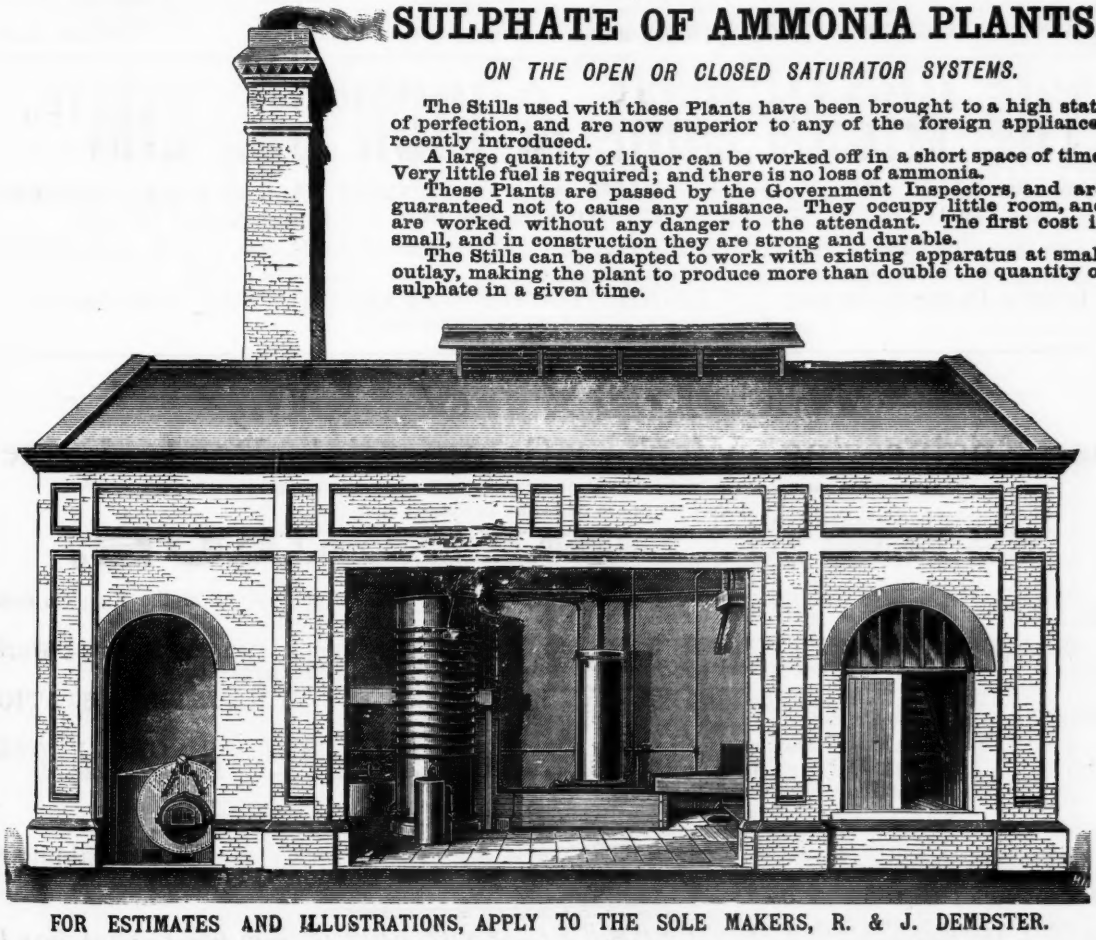

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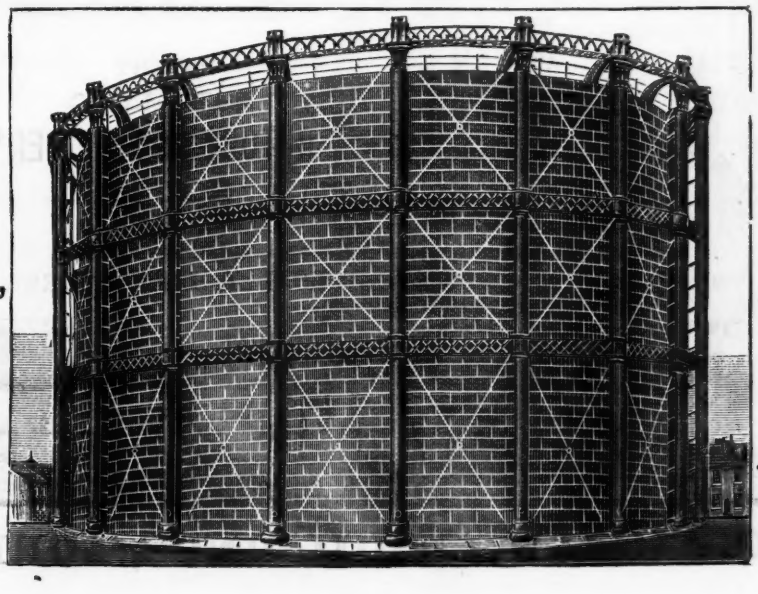

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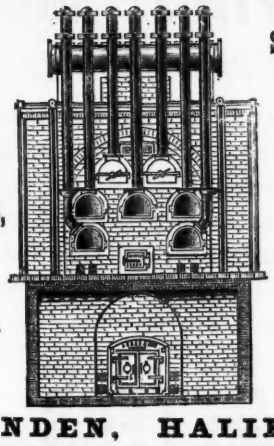

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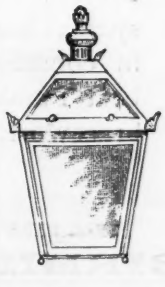

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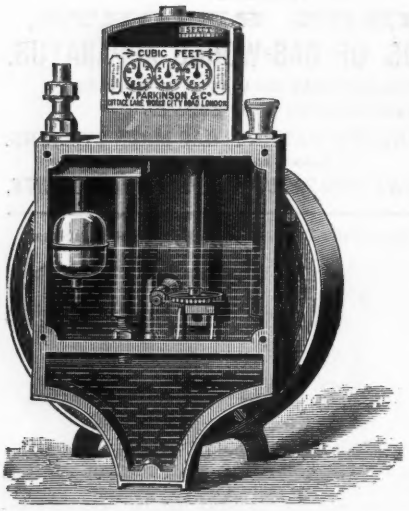

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[See also Advt. p., 58.

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